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THE AMERICAN GAS LIGHT JOURNAL

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Correspondence.—Wishing to make this JOURNAL a gazette of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, correspondence is solicited for publication from all who make the study of those subjects a pleasure or a profession.

The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

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[OFFICIAL NOTICE.]

Appointment of a Committee of Reception by the American Gas Light Association.

AMERICAN GAS LIGHT ASSOCIATION, OFFICE OF SECRETARY, PROVIDENCE, R. I., June 5th, 1893.

The following named members of this Association are appointed and respectfully requested to serve as a Committee of Reception, whose duty shall be to call upon all foreign gas engineers visiting our country during the continuance of the World's Fair at Chicago, whose names and addresses may be obtained, and to introduce them to other members of our profession, see that they obtain permits to visit the neighboring gas works and other objects of interest, and generally to make their stay in New York as pleasant as possible, and when they leave for Chicago, to give them letters of introduction to the Committee of Arrangements at Chicago: Messrs. Wm. Henry White (chairman), Eugene Vanderpool, William H. Bradley, Fred. S. Benson, William R. Beal, Jos. R. Thomas, Thos. F. Rowland, Jr., Fred. W. Floyd and Oscar Weber.

The Guild of Gas Managers and the Society of Gas Lighting are respectfully requested to co-operate with this committee in extending hospitality to our visiting professional brethren.

A. E. BOARDMAN, President.

A. B. SLATER, JR., Secretary.

[OFFICIAL NOTICE.]

The American Gas Light Association's Greeting to European Gas Engineers.

AMERICAN GAS LIGHT ASSOCIATION, OFFICE OF SECRETARY, PROVIDENCE, R. I., June 5th, 1893.

To the European Gas Engineers—Greeting: The American Gas Light Association will hold its 21st annual convention in the city of Chicago, beginning on the date of Wednesday, October 18th, 1893. It would give the members of the Association great pleasure to meet there as many of the European gas engineers and managers as can make it convenient to be in attendance at the World's Fair at that time. It is suggested that all contemplating visiting the Fair arrange their visits so as to be in Chicago, if possible, at the time of this convention, when they will be most cordially welcomed by the Association and invited to attend the sittings of the body and participate in its discussions of papers presented.

Those engineers who cannot conveniently visit the World's Fair at that time, but must choose some other date, are respectfully requested to send their names and addresses, as soon as they arrive in America, to the AMERICAN GAS LIGHT JOURNAL, No. 32 Pine street, New York City, so that a committee from the Association may be made aware of their presence, and when they may be met, so that they may form the acquaintance of their professional brethren in this country and be made to feel less like a "stranger in a strange land."

A. E. BOARDMAN, President.

A. B. SLATER, JR., Secretary.

BRIEFLY TOLD.

GAS WORKS AND LABOR RATES.—The spell of extraordinary depression and erratic unsettlement of values in which the country is now held has brought out one thing with great prominence, and that is the fact that the great problem of the day and time is the labor question—not that it has not always been a perplexing question, with the likelihood it will ever continue such; but it seems that the conditions of trade to-day, if development in our general commerce is to go on with anything approaching its former ratio of progress, imperatively demand that the employee must submit to a curtailment of his receipts in some degree commensurate with the curtailment that the employer has already experienced in the percentage of profit that comes to him from the sale of that which is produced as the result of his direction. Labor, no doubt, is honorable and great; but there is also no doubt that it is unreasonable and grasping—as grasping as ever was capital. The era of trades unions and labor combinations has been with us for some years, and while the net result seems to have been for the employed a good round increase in wages and a marked decrease in the number of hours of their laboring, the effect on the employer has been a still greater decrease in the profit on his wares in the market—a decrease that in percentage is much larger than the percentage gain in a money point of view to those whom he employs. If the consumers of those products were the beneficiaries, if they were the ones who, through a decrease in the selling values of the products they purchased, to the full sum of the difference between the old rate of profit to the manufacturer and the new rate of profit to him under the existing payments on labor account, then there would be the less cause for discontent, in that the greatest number were being directly benefited. Where must we look, then, for an explanation of the discrepancy that exists? To us it seems there can be but one way of making it clear. The workman is paid higher wages and granted lesser hours, only to the end that his value as a producer is less. In other words, that which comes now from his hands is neither so prolific nor completed as that which came from his hands in the days of lesser pay and longer working. In any event, it would seem that labor rates are too high if the manufacturer or employer is to keep open his place of trade. Turning to the direct bearing of this question on the gas industry, we are confronted with the certain knowledge that in this city, for instance, the price of gas since 1870 has been reduced 60 per cent., whereas the labor rates have not declined to exceed 20 per cent. The decline in the prices of raw materials in the same period—taking iron and other building materials, coal and lime—may be averaged out at 66 per cent., and taxes, through the variety of legal enactments, placing assessments on capital stock, dividends, etc., have increased, say, 4 per cent., wherefore it is seen that the only force which has not assisted in the decreasing of the price of gas to anything like the ratio it should is the force of labor. As the example of New York City stands in respect of the gas business, we think it may be fairly taken as a type of that existing in other parts of the country, and we are of the opinion that the labor in and about gas works would not be treated unfairly were it asked to submit to a just revision of the rate of payment made to it.

MR. FRANCISCO ON THE "FALLACY OF MUNICIPAL OWNERSHIP."—Elsewhere we reprint an article, by Mr. M. J. Francisco, printed in the last issue of *Engineering Magazine*, which we imagine will not be heartily relished by the thick-and thin advocates of what is termed "municipal ownership." It is true that Mr. Francisco's argument is chiefly directed to the operation of electric lighting plants on municipal account, but as there is very little difference in the principles underlying the operation of gas and electric lighting plants, every word that he wrote bears with equal force on each system. In fact, he cites the Philadelphia municipal gas plant as an example to prove the fallacy of the paternal idea. His references to the "bookkeeping" that rules in making up the estimates at different points of the cost of an arc light per annum are sure to be appreciated, even if they do seem to show that figures can be liars—even if self-confessed ones. Beyond a doubt, it is difficult to understand how the Selectmen of Peabody, Mass., can bring themselves to believe that different sums aggregating $5,752, paid out for court expenses, salaries, attorneys' fees, and so on, may be rightfully charged as assets. To an ordinary observer this would look like having one's cake after the same had been masticated; and they (the assets) certainly would not be accepted by any money lender as safe collateral for a loan; still there is nothing impossible to a City Father.

MR. THOS. TURNER has reason to remember the recent cyclone, Charleston having been directly exposed to its severest fury. The gas works fires were put out by the floods, and, between wind and water, the new holder was badly warped. Brother Turner, however, was equal to the occasion, temporary repairs having been pushed with such celerity that gas was "off" the city only a short while.

[Prepared by Mr. M. J. FRANCISCO, for the *Engineering Magazine*.]

The Fallacy of Municipal Ownership.

The subject of municipal ownership of lighting plants is at the present time attracting widespread attention. Statements favoring such control have been made, in which serious errors appear, calculated to mislead the public in regard to the cost of electric lighting. These statements have been made by parties whose interests—and in many cases their positions—have depended upon a favorable report of the cost of the lights. Nothing is easier than to make the claim that municipalities can and do furnish lights at lower rates than private companies, but no attempt is made to prove the assertion, and mere words are not evidence. Not an instance can be shown where municipalities have furnished the lights at a less cost than private companies, if all the expenses are considered and the facts are candidly stated.

There are many intelligent men who are opposed to the scheme, because of the political dangers to the nation and State and to municipali ies themselves in this attempt to control private industries. No sober-minded citizen can fail to recognize and admit the objections to the plan, and no one will pretend for a moment that it is not surrounded by grave difficulties and uncertainties. Consider for a moment the effect if all the capital and employees of the railroads, telegraph, telephone, and electric light companies were placed under government ownership and control. Not only would an indebtedness be created almost beyond the limits of computation, but an army of employees whose magnitude would dwarf the combined military forces of the world would be added to the political machine. Even the strongest advocates of municipal ownership must admit the danger of such an army of employees subject to the manipulation and control of any political party. The principle advocated in municipal control is the same as in national control, only upon a smaller scale, and the result can be traced even in insignificant municipalities where it has been tried.

Private companies are not paid a proper price for lights at the present time, as is shown conclusively by the fact that thirty-three of fifty six electric lighting companies doing business in Massachusetts could not pay any dividend, while the average dividend paid in one year by the whole fifty-six companies was only .0235 per cent. If private companies, with all their skill and close business management, can barely pay expenses at present prices, how can a municipality be benefited by engaging in the business, while relying for service and information upon politicians and municipal managers lacking experience and changed at every election? Even where the officials are honest in the performance of their duty, they are. in the words of ex-Mayor Hewitt, "constrained and overruled and compelled to reward political service by public office."

It is conceded by all who have had experience that an electric plant requires the most careful attention and all the skill and sagacity that can be secured to make it a success, even when conducted by men who are financially interested in it, who feel in their pocket the cost of every expenditure, and whose entire fortune may depend upon its successful management. It is admitted that a man pays closer attention to business details and economy where he has the most at risk. In all municipal enterprises there is a lack of attention to mechanical and other details which must be carefully watched and guarded in order to insure success. No sane or fair minded man will, with the corruption and fraud practiced by politicians at the present day, attempt to prove that it is for the best interest of the taxpayer to place faith in the honest or conservative management of any enterprise which can be manipulated in the political arena for the advancement of the men in power. Human nature is the same the world over and will be forever. The best guide of what the future has in store is a comparison and study of the past. The histories of New York, Philadelphia and many other cities are samples of what will be done for political preferment. In every case the records show that it has been for the best interest of the citizen and taxpayer to contract with an electric light company for lighting streets.

Where a municipality owns the plant there are many ways by which the cost can be reduced apparently besides the practice of true economy. Officials see no necessity of inauguarating strict business methods when a plausible statement that there is a reduction satisfies the public. The cost of lights under municipal ownership is not always correctly reported to the committees and city officials who are investigating the subject. An examination of the reports given to representatives of Mobile, Scranton, Milwaukee, and Steubenville by the authorities at Little Rock, Chicago, Ypsilanti and Aurora shows that no two reports from the same place agree.

The authorities at Ypsilanti reported to the committee from Mobile

that the cost of their lights was $33 79; to the committee from Scranton that it was $23.61; and to the committee from Milwaukee, $37. Then the Steubenville committee were informed that the cost was $40, and in the last report to the Mayor of Watertown they state it costs $46 per lamp per year, or double the cost reported to the Scranton committee. The same variations are found in reports from other cities owning plants. If the records and accounts are properly kept, why do not these reports agree? The advocates of municipal ownership claim that the city of Philadelphia is making money on its gas plant, but the committee sent there by the Massachusetts legislature made an investigation and reported that Philadelphia was losing $106,144.26 per year in running her municipal plant. The folly of small cities loading themselves down with debt to install a municipal plant has been illustrated time and again. In addition to the tax to be levied for the payment of interest and principal, there is the annual expense of running the plant and repairs to be made, thus placing a burden upon its citizens which cannot be overcome in years, besides driving would-be citizens away on account of the heavy taxes caused by these debts and expenses.

Many cities have been induced to adopt municipal ownership under false impressions. Their Councilmen were deceived by the statements regarding the cost, supposing the figures furnished by municipalities owning plants to cover all the charges. After adopting the plan they found that electric lights could not be run as successfully or as cheaply under municipal control as when furnished by private companies. They are, therefore, trying to unload with as little loss as possible. In illustration of this the experience of Greenville, Carrollton, Hope, Stockton, Lyons, Marcaline, Michigan City and Portland, which have tried and abandoned municipal ownership, may be cited.

In the list of cities quoted by the advocates of municipal ownership, the price per year in a place using water power and only running 20 nights a month, until midnight, is compared with the price of private companies using steam power and burning all night and every night in the year. Then the reason given for the difference in price is that in one city the municipality owns the plant and in the other it is furnished by a private company. The liability that a city assumes when it owns a plant is never included in the estimate, and the armatures destroyed are not reported as an expense or loss; neither are the accidents reported, though in many cases these may cost thousanas of dollars.

An investigation of 29 city-owned plants shows that the average cost per hour is 0.564 and the average candle power per hour for 1 cent is 361. A like comparison of 29 private plants furnishing lights under contract shows that the cost averages .0374 per hour, and the candle power per hour for 1 cent is 576. This investigation shows that in nearly every case the cost per hour, where a contract is made with a private company, is less than when light is furnished by the municipality; also that the candle power for 1 cent furnished by the private company is more than that produced by the municipal plant.

Reports from a large proportion of the municipal electric lighting plants in the United States demonstrate that the average cost per lamp per year is $116.46, while the average candle power per hour furnished for 1 cent is 402. Like reports from 1,000 electric light companies, embracing both steam and water power plants, and furnishing lights under contract, show that the average price per lamp is $100, the average cost per hour .0357, and the average candle power per hour furnished for 1 cent, 560. By a comparison of these two classes of reports it will be seen that the average price under municipal ownership is $16.46 per lamp more than it is where contract is made with a private company; also that the candle power per hour furnished for 1 cent is 158 less when furnished by municipalities than when private companies are producing the lights. In the reports of cost of lights where the municipality owns the plant all of the expenses are not given, and in many cases part of the expense is charged to other departments and no allowance is made for interest, depreciation, taxes or insurance, though these are items that practically affect the taxpayer as much as the bills for coal.

The municipal plant at Allegheny, Pa., suffered a loss by fire, and when the insurance was paid, the city officials deducted the amount paid by the insurance companies from the running expenses, claiming that the balance was the cost of running the lights. The query arises: If this plan is adopted, how long will the buildings last, and must they burn one every year to make the expenses correspond with the present report? Danville, Va., lost an armature costing $500, and then the station burned and there was a loss of $9,000, as the property was not insured. Can you find any reference to these losses in the reports that are being circulated regarding cost of lights in Danville? Yet they are part of the cost to the taxpayers.

In Bay City, Mich., a report was made to the taxpayers, in which it was shown that the expense of 150 lamps for one year was $11,683.03. They also stated in the same report that "the actual cost of a light for one year was $46.20"—that is, under municipal ownership, when you divide $11,683.03 total expense by 150 (number of lamps) the quotient is $46.20! This is a sample of municipal bookkeeping.

Danvers, Mass., has been cited as an example of the success of municipal ownership. Upon an examination of the town report we find the lights are only run 1,500 hours per year, cost .0568 per hour, and only furnish 211-candle power per hour for 1 cent. The expense of the legislative committee, amounting to $1,635.84, is charged to construction; how much can the town realize from this item as an asset? Easton, Pa., is another city where municipal ownership has been tried. The mayor in his last message said: "In Easton the cost is claimed not to be over $87 per year, but both the City Treasurer and Controller, who are familiar with the subject, claim that the cost is far in excess of these figures, and may reach the highest figures of any city which owns its own plant." An examination of their business demonstrates that the cost is $147.22 per lamp per year, and .0457 per hour, only furnishing 437-candle power per hour for 1 cent.

In an article in the *Review of Reviews*, Hannibal, Mo., was cited as affording an instance where the benefits of municipal ownership were apparent. They had a cyclone which damaged the station badly, and the repairs cost $711.88 cents. Instead of charging this to repairs, where it belonged, they charged it to construction account. In this way taxpayers were led to believe that they had improved the building that much, whereas they had only repaired the damage caused by the cyclone. Clearly the money thus expended was a loss, and should have appeared in the loss or expense account. They have burned out five armatures, and the claim was made that these were destroyed through ignorance and carelessness; but this must be expected where management is controlled by the results of an election.

Referring to the table given in the article in the *Review of Reviews*, we find, under the heading of prices paid to private companies by cities for lights, that Sedalia, Mo., running on "moon schedule," the same as Hannibal, is furnished 2,000 candle power lamps for $87 per year, the cost being .0397 per hour, giving 564-candle power per hour for 1 cent. Thus it will be seen by their own table, where they give the price of private companies, that Sedalia is receiving 134 candle power more per hour and at a cost of .0143 less per hour than Hannibal, after crediting the latter place with the income they receive of $4,000.

In Marietta, O., the lights produced by the municipal plant cost .0589 per hour, furnishing 339 candle power per hour for 1 cent. The City Superintendent also has charge of city buildings, prison, and fire department, and his wages are charged to those departments; the city prisoners are also used for handling coal. Parkersburg, W. Va.—only 12 miles from Marietta—is supplied with lights by a private company for .0265 per hour, being .0324 per hour less than it costs Marietta. In addition, Parkersburg receives 754-candle power per hour for 1 cent, getting more than double the light that Marietta does, at less cost.

Peabody, Mass., established a plant, and in four months' time discovered how $12,107.43 (the expenses) could be divided by 146 (number of lights) and show a yearly cost of lamps of only $68.72. This system of mathematics will work successfully only under municipal ownership. In their assets are included $1,500 paid for court expenses, and $500 expenses before legislative committee. In addition there are salaries, attorney's fees, rent, and other items of expense, amounting to $3,752, charged as assets, but which belong in expense account.

Can anyone produce a statement showing the cost of municipal lights in Topeka, Kansas, that includes 12 armatures they have destroyed, costing $4,800? Ypsilanti, Mich., in 1890 had running expenses of $2,500; now they are $3,800, and steadily increasing. The authorities were asked if, with their experience, they favored cities doing their own lighting. They answered "no," for political preferences and frequent changes of management are too expensive—incompetent engineers, linemen and trimmers are kept in place by a committee for political or other purposes; and poor carbons, lack of attention generally, grounding of wires, breaking of globes, and constant repairs make this system expensive, and the cost an unknown amount until the year expires. All kinds of complaints and no responsible head is the rule.

This is municipal ownership, the new potitical machine of the nineteenth century.

Improved System of Smelting Steel by Oil Gas.

Some extended experiments on direct oil burning and oil gas for smelting steel and other heating purposes have been tried of late in the steel districts of the United States, but no particular system has yet found anything like general favor, and the belief amongst manufacturers

where natural gas is used that when the latter is exhausted (a stage all too rapidly approaching) is that an artificial gas must again take its place.

Mr. T. V. Lloyd, furnace builder and retort setter, of Cardiff, South Wales, now in this country, has invented a producer for manufacturing gas from crude oil for heating open hearth steel furnaces. The apparatus consists of four square retorts, 2 feet x 2 feet, inside, x 6 feet long, set vertically between the regenerators and the chimney, so that the waste heat, after passing through the checker work, heats the retorts. Dampers are arranged to allow the air, which is reversed every half hour, to pass through the checkers, instead of being transmitted from the flues of the retorts, thus avoiding destruction and cooling of the apparatus.

The retorts are filled in with checker work, 1½ splits, set on edge, and are fitted with top and bottom mouthpieces. The oil is admitted through the top cover into a brick tube, 3 inches in diameter, formed in the cen ter of the retort. A small jet of steam is admitted in the same chamber, to force the oil to the bottom of the producer. The bottom mouthpiece is fitted with a perforated lid, placed inside the cover, for distributing superheated steam. The oil is then decomposed as it passes through the checker work. The hydrocarbons are then drawn off by an exhauster, which is passed to a governor, and then to the furnace, and is admitted in the same manner as natural gas at the neck of furnace. The apparatus is so arranged that the retorts can be heated by oil to generate gas for the starting up of a new furnace. The producer is entirely in charge of the lever man, and all dampers and valves of furnace and producer are worked from an elevated platform.

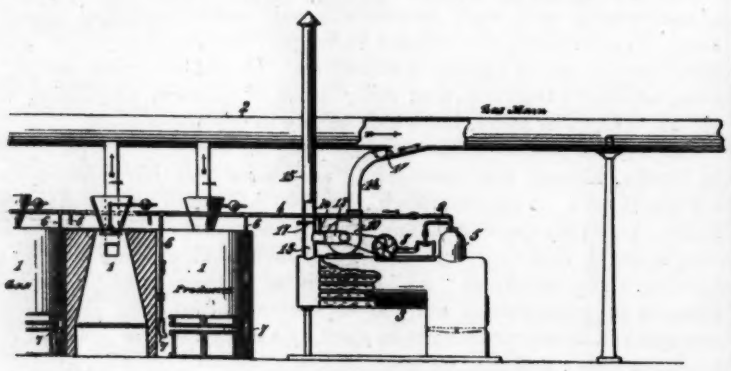
Method of and Apparatus for Propelling Producer Gases.

On August 22d U. S. Letters Patent (No. 503,842) were granted to Mr. Wilson H. Forbes, of Jeannette, Pa., for an invention relating to the working of producer or generator furnaces having steam blast appliances for forcing the gases to regenerator furnaces employed in the man ufacture of glass, and for other purposes. Using the words of the inventor:

In this type of apparatus it is essential to introduce the steam at high pressure into the producers or generators, for the purpose of obtaining the requisite draft to force the gases through the gas main to the regenerators, and the steam at the necessary high pressure cuts out the brick work structure, which is damaging and therefore objectionable.

The objects of my invention are to enable the producers or generators to be worked with steam at less pressure; to increase the heating capac ity of the producer or generator gases, and propel them to the regenera tors or other places to be utilized without cutting out or damaging the producer or generator brickwork, or danger of an explosion.

To accomplish all these objects my invention consists in the method and apparatus hereinafter described and claimed for propelling and in creasing the heating capacity of the producer or generator gases.



In the accompanying drawing the figure is a sectional side elevation, illustrating gas producers or generators, a gas main leading therefrom, and a boiler furnace connected with the gas main in accordance with my invention.

In order to enable those skilled in the art to make and use my invention, I will now describe the same in detail, referring to the drawing, wherein the numeral 1 indicates a series of gas producers or generators; 2 the gas main connected therewith in the usual manner for conducting the gases to the regenerator furnaces or other place where such gases are to be utilized.

I do not deem it necessary to illustrate the regenerator furnaces, as they are of well known construction and arrangement.

The numeral 3 indicates a boiler furnace, having a steam conveying pipe 4 leading from the steam dome 5, and having branches 6 connected with tuyeres 7 which deliver steam to the producers or generators for draft purposes. A pump 8, mounted upon or otherwise arranged in juxtaposition to the boiler furnace, is provided with a steam pipe connection 9 with the steam dome 5, and this pump is geared to the shaft of an exhausting and forcing apparatus, such as a rotary blower 10, having the exhaust pipe 12 connected with the smoke box 13 of the boiler furnace, and the branch 14 connected with the gas main 2. The pipe 12 and the smoke stack or chimney 15 of the boiler furnace may be provided with dampers or valves 16 and 17, whereby the products of combustion from the boiler furnace may be caused to pass out of the smoke stack or chimney, or into the exhausting and forcing apparatus. The pipe 14 leading from the exhausting and forcing apparatus is preferably provided with a valve 18 which permits the products of combustion to flow into the gas main, but prevents backflow into the pipe 14. When the producers or generators are working, the products of combustion from the boiler furnace are conducted into the gas main, and serve to propel the producer or generator gases through the gas main to the regenerator furnaces, or other places where the gases are to be utilized, and, by the mingling of the products of combustion with the producer or generator gases, increasing the heating capacity of the latter, which is a very desirable feature in working glass furnaces where a very high temperature is essential.

By propelling the producer or generator gases through the medium of products of combustion from a separate furnace forced into the gas main, it is possible to materially reduce the pressure of the steam delivered to the tuyeres of the producers or generators, which is a very important and desirable feature, in that ordinarily the gases from the producers or generators are forced through the gas main by the pressure of steam introduced into the producers or generators by the tuyeres, and this high pressure cuts out the brickwork structure, and is damaging. By my invention this is avoided, and the heating capacity of the producer or generator gases is materially increased without danger of an explosion which would likely result if atmospheric air were forced into the gas main, and without liability of choking up the gas main by the rapid accumulation of carbon, as would likely occur if steam were introduced directly into the gas main to the gases in transit to the regenerator furnaces.

By forcing the products of combustion from the boiler furnace into the gas main, the gases from the producers or generators are propelled to the regenerator or other furnaces used in the manufacture of glass, and for other purposes in factories, and the heating capacity of the producer or generator gases is materially increased; while the steam pressure employed to create the usual artificial draft in the producers or generators can be greatly reduced to avoid damage by cutting incident to steam entering at a high pressure.

The Electrical Engineer and His Work.

By Mr. George D. Shepardson.

The rapid growth of electrical industries has attracted the attention of a large number of men who look to it as a means of earning a living, and in many cases with a fond hope that it may prove a source of wealth. This is indicated by the fact that electrical manufacturers have on their books, "for future reference," applications by the hundred from men and boys of all ages and qualifications. Indeed, so great is the supply of learners that it is hard for a beginner to secure a situation even for nominal wages.

It is also seen in the increase of the number of college students looking forward to electrical engineering as a life work. Five years ago the institutions offering courses in electrical engineering might be numbered on the fingers of one hand; now they are counted by scores. The growth of the work is illustrated by the fact that in 1884 there were 28 students in the electrical engineering course of Cornell University, while in 1892 the number had grown to 275. In the schools offering a course in electrical engineering a tendency exists for students to crowd into that course. In the University of Minnesota half the freshmen in the College of Engineering, Metallurgy and the Mechanic Arts are registered for the electrical engineering course.

There must come a reaction from this tendency, for there are equally great opportunities in other lines of engineering. Indeed, the work of most "electrical engineers" is largely something else with a little electrical work added.

The supply of beginners is greater than the demand. Many of these students who rush into the electrical course are utterly unfitted to be-

come engineers, having neither the ability, perseverance nor genius. Some have the idea that if they are too lazy to be farmers, too slow and dull to be successful in business life, or have not had and will not get education and culture enough to follow a so called learned profession, they will become engineers. They may succeed in becoming threshing machine engineers, but they would better save the time and money spent in trying to become what they were never intended to be. Engineering involves a long and thorough training. One must have a taste and a talent in that direction ; must possess the ability to perform a great deal of hard and unromantic work, often for twenty-four or even sixty hours at a stretch, carry heavy responsibility, control men and manage work ; do the work of three men at once when necessary, and be "up early and always at it."

The causes of this movement into electrical work are several. Perhaps foremost is the idea that electricity can do everything, therefore, the electrician can do everything and build up an enormous fortune.

It is true that some electricians have built up great fortunes and many are doing it to-day. Electricity is being used in nearly every line of industry, and electrical processes or methods are rapidly displacing others on account of superior adaptability, efficiency and economy. The capitalist here finds safe and profitable investment, the inventor and engineer find ever-widening and attractive fields of labor. Many inventors in electrical lines as in others die poor. To be merely an electrician or merely a great inventor does not insure financial success. The men who grow rich in this field are two classes—the sagacious ones with little or no electrical knowledge of their own, but with much knowledge of men and market, keen foresight and wide-awake business ability ; and those who combine inventive genius and extensive knowledge of electricity in theory and practice with more or less of the above endowments.

Such men would grow rich in almost any field of activity. Aside from dollars and cents, there is a peculiar fascination in the study of electricity and a pleasure that comes merely from experimenting with the unseen but not always unfelt force. There is a certain satisfaction in being informed upon this wonderful form of energy. The great variety of phenomena offered is an unending source of interest. Many new phenomena are being discovered and new applications are continually being made. There is always open to the intelligent, inquisitive and reflective student the possibility of making new discoveries of greater or less importance. The latter, aside from financial possibilities, is indirectly a great attraction to the class of people whose highest object in life is to make themselves useful to others and to make this world a better place to live in. Which of these reasons is the more potent depends upon the individual.

Electricity is entering into modern life in so many different ways that an infinite variety of positions require more or less thorough knowledge of electricity. The variety is so great and shading from one class to another is so gradual that it is impossible to make any hard and fast classification. Comparatively few positions require simply electrical knowledge. Standardizing bureaus for calibrating instruments, testing apparatus, questions of theory, many lines of investigation, and some lines of invention might be classed as purely electrical, but as a general rule each one of these lines of work involves more or less thorough knowledge of chemistry, mechanical engineering and business methods.

One might divide electrical workers into two classes, the first embracing those who manufacture (this includes design, construction, testing and repair) and install or operate electrical apparatus. The second class includes a large number of people who have to do with electricity only in the abstract or indirectly, such as capitalists, promoters, patent attorneys, lawyers, editors, writers and teachers. The latter class is one of great importance. Electrical developments would be slow indeed without the help of capitalists. This assistance would be slow to come were it not for the useful work of the promoter or middleman. Much money has been wasted and injury done to the reputation of legitimate electrical enterprise by the wildcat speculation and cut-throat competition brought about by the zeal of unwise or dishonest schemers. It is a remarkable fact that the man who would not for a moment think of cutting for himself a $2 vest would not hesitate to rely upon his own judgment when considering the investment of thousands of dollars in some electrical scheme of which he knows nothing except the representations and promises of an interested agent. In the early days there were no experienced engineers except those in the employ of the large companies. Many of these have graduated from the companies in the last few years, and are in business for themselves as disinterested and well qualified consulting engineers. Capitalists are learning to make proper use of the experience of others, to the mutual advantage of themselves and the engineers.

The rapid growth and differentiation of electrical industries is accompanied by a corresponding development of the technical press. Many papers find a wide circulation, some of them devoting themselves to particular lines. Nearly all the engineering papers have electrical departments, and the day seems not far distant when the great daily and weekly newspapers will employ electrical or engineering editors, or at least reporters who are intelligent on electrical subjects. A good demand exists for well-written articles treating of electrical matters in a popular style. In many cases it is true the men who are capable of writing correctly are too busy to write, and those who do write are only partially informed.

There seems to be a steady demand for good teachers in electrical engineering. Such a position requires considerable experience in various lines of commercial practice, combined with a thorough education and a willingness to work. It is an accepted fact that men who are competent to fill such positions obtain at least twice as large salaries when the same ability and energy are employed in commercial work. An editorial in a leading electrical paper says : "It would seem as if technical education of an engineering nature, owing to its importance in the industrial world, demands the employment of the best men obtainable, and if our leading universities expect to obtain these men they must offer them such inducements that positions of this kind will be chosen in preference to commercial work." As a matter of fact there were more than a dozen vacancies of this kind last September, and some of them are still begging. The comparatively small salaries of this class of work are partially compensated by the opportunity for study and original investigation, the cultured society and other advantages that cluster about an educational center. Not the least is the satisfaction that comes from helping others. Electrical business is becoming so complicated that a growing number of lawyers are devoting their entire attention to obtaining electrical patents. For such a position an extensive knowledge of all sciences is desirable.

After completing a scientific or technical course and a law course the preparation sought by many patent solicitors is to spend some years in the United States Patent Office as examiners. The Government holds examinations at stated times and places for the purpose of examining candidates for these positions. The salaries are fair and the work is an excellent preparation for those who expect to become patent lawyers.

Closely allied to these are what might be called electrical lawyers, who make a specialty of electrical cases. It is a deplorable fact that a large part of the money made by electrical inventions has been used up in litigation between rival companies. The present tendency of the companies to consolidate makes it questionable whether this branch of the legal practice will continue to flourish as it has in years past.

The first class includes, further than were named, those who are generally called "electrical engineers," and the large number of people who call themselves "electricians." Under each of the sub headings are all grades of work. It is assumed that the student is aiming at a high position, and we shall therefore consider the various lines of business of which he may become manager.

There is a good field for the electrical manufacturer. In electrical industries as in others there has been a tendency for manufacturers to combine and form what are essentially monopolies. In this way they obtain control of patents that would render competition impossible were it not that the courts do not generally render final decisions until a patent has almost expired. The monopolies created by the control of patents have practically shut out competition in the telephone and storage battery business in this country. Now that the telephone patents are expiring, new telephone companies are springing up on all sides, and some of them will do a profitable business. The General Electric Company controls an immense number of patents which, if sustained by the court, will give them a practical monopoly of electrical railway work. In the early days of electric lighting, when there were but few companies, one "system" was used throughout each plant and the owners were usually compelled to buy all supplies from the parent or manufacturing company. The same was true in electrical railway work. As new manufacturing companies were organized and began putting their goods on the market, it was found that certain parts of the apparatus of one company were better than the corresponding apparatus made by another company. Careful buyers soon began to use their own judgment, bought supplies wherever they could buy them best and whatever suited them best. This opened the field for manufacturers of a few special articles or lines of goods, and to-day this is one of the most promising fields for manufacture. It requires so much capital to carry on a general electric manufacturing business by modern methods that most companies are contenting themselves with manufacturing a great many of a few things. If one could obtain control of the manufacture of some specialty for which there is or may be created a demand, there

is a fair chance for it to succeed, provided, of course, it is well managed.

It used to be the universal custom for manufacturers of electric light and power apparatus to install plants themselves, but as the business became older, independent concerns took hold of this business, buying their supplies wherever they pleased. This is true of other electrical lines except the telephone and perhaps a few others which were monopolies. The supply and contracting business has a large field and furnishes occupation for a great many.

The supply business is attractive to many, and there is room for a supply house in almost every city. The character of the business will depend largely upon the size of the city and its nearness to great business centers. There are so many different lines of electrical work that a supply house must command an enormous capital in order to carry a stock of everything that may be needed. There is a growing tendency for supply houses to restrict their stock and handle a limited number of specialties.

Closely allied to the supply business is contracting. Most electrical contractors keep a certain amount of stock on hand, and many of them are agents for manufacturers. The knowledge and training necessary for a contractor will vary with the nature and size of the work he is doing. If he is simply an "electrician" and "locksmith," he needs to know how to set up a sal-ammoniac cell and how to run annunciator wires, simply following the diagram given in the supply catalogue. Such men often think they can put in wiring for lighting houses, and numerous sad tales might be told of their successes and the misfortunes of their patrons. The owners of a certain building in Minneapolis are said to have paid $11,000 for wiring which is entirely worthless on account of poor work. There is a steady business for contractors who wire buildings properly for lighting purposes; also for agents for various companies. This is probably one of the safest lines for establishing a steady electrical business.

In almost every section of the country there is a considerable amount of electrical repair work to be done. Electrical apparatus will wear out and meet with accidents. Much repair work is sent back to the factories, but in many cases the freight or express charges will amount to as much or more than the simple cost of the repairs. Large plants do their own repairing, but owners of small plants cannot afford to keep skilled help, and therefore must have their repairs done elsewhere.

The consulting engineer who has established a reputation finds a wide demand for his services as a designer of new plants; for examining into new schemes or inventions that are seeking aid of capitalists; for testing plants in operation or in construction; for assisting in developing new inventions and in similar cases that may be intrusted to him. He should be a man of broad education, of thorough technical training, wide experience in business and in the actual operation of electrical plants.

The consulting engineer is often at the same time a contractor. The business of consulting engineer is often difficult, but is capable of being developed to a much greater extent than it is at present. There is an opportunity in this connection for excellent work to be done in educating capitalists who propose investing in electrical interests. Large sums of money that might have been turned to profit, if at the outset proper consultation had been made with competent engineers, have been wasted upon electrical schemes.

The third division of the first class, viz., operators of electrical apparatus, includes a variety of positions, limited only by the number of purposes to which electricity is applied. The safe and economical operation of an electric concern of any magnitude requires intelligent supervision by a competent electrician. The demand for educated electricians is continually increasing. Technical students seem to think that the most promising, in fact, almost the only field for an educated electrical engineer is in electric lighting or transmission of power. These are, indeed, great fields, and there is also a great rush of experienced engineers in these directions. One is inclined to repeat the proverb, "Where everybody goes, do not go." In other words, if one will strike out into new fields where he meets less competition, it is also likely that he will more easily make a success. There are other fields which are now open, but in which little progress has been made, simply because they have been left to inferior or poorly prepared men, or have been given little attention. For example, inquiry was made at an electrical supply house on prices for electric gas lighting apparatus. The writer was shown a handsomely finished spark coil costing $80, and was assured that it was operated only by one cell of battery which would cost 50 cents. The probabilities are it would have been much more economical to use a cheaper coil and more battery. There seems to have been no investigation as to the best relation between the cost of coil and the cost of battery. There certainly is room for careful investigation and improved designing in this field.

Abundant opportunities for men who can combine electrical knowledge with good management are open in the superintendence of electric light and railway stations, telephone exchanges, telegraph lines, electroplating and electro metallurgical works and other establishments that apply electrical energy to commercial processes or operations. In each of these and in various other positions that might be mentioned, there is always need of intelligent supervision, a multitude of details to be looked after and new methods to be investigated. The financial failure or success of such establishment often depends upon the wisdom of the superintendent and the skill with which he manages details, which may be small individually, but, in the aggregate, determine whether there shall be dividends or assessments. A concrete example of this will be worth giving in some detail.

The writer is somewhat acquainted with the methods adopted by a large electric road in improving its service while reducing its repair account. It is thought that the result of this experience will be of interest and value to others who are struggling against heavy expenses in the repair shops. By careful management this road has accomplished wonders. The number of men employed in rewinding armatures has been reduced from 65 to less than 20, and corresponding improvements have been effected in other departments. This has been accomplished by the employment of trained electrical and mechanical engineers who are giving careful attention to details. The men in charge of the motors and cars are furnished with a book giving clear explanations of the various parts of the car and its equipment, illustrating and explaining so far as desirable the purpose of each part. They are taught how to take proper care of the motors and how to make ordinary repairs in case of accident on the road. Specially trained inspectors are out on the line at all times looking after motors that are not working perfectly. These inspectors endeavor to see that everything is working properly. If anything is out of order they repair it at once or send it to the shop before a bad matter is made worse by neglect. Experience shows that these inspectors save their cost to the company many times over.

In the repair shops great attention has also been given to details. Careful observation of the scrap heap and of the "cripples" has pointed out a number of wrinkles which, small in themselves have in the aggregate amounted to much. The adoption of taper fits on pinions and commutators has been the means of saving much time and much swearing in the shops. By altering the shape of the commutator bars and by pressing down the ends of the armature wires so as to form a sort of "goose neck" where they are soldered to the commutator bars, broken armature leads have become a thing of the past. In all parts of the shops everything is made to gauge so as to be interchangeable. The repair shops are running on a manufacturing basis with great economy.

In one of the engine rooms a small change in the piping reduced the drop in pressure between the boilers and the engine from 15 pounds to less than 2. The saving of fuel from this single device will more than pay the chief engineer, who made the experiment.

These are but a few of the improvements brought about as a result of the careful investigations and recommendations of trained engineers. It is a significant commentary on the claim sometimes made by ignorant or prejudiced men that educated engineers are not worth their salaries. It also suggests that many roads and other electrical industries that are running at a loss, barely paying expenses, or even those that are paying large dividends, would find it a valuable investment to secure the services of thoroughly trained engineers who can combine theory with practice.

The education and training that a person needs to fit him for his work will depend largely upon the sort of position he may occupy. In most cases the more he knows the better. The more knowledge he has of chemistry, mathematics, physics, mechanical engineering, business methods and human nature, the better prepared is he for his work. The field is so broad and the number of positions so widely different that it would be impracticable to discuss in detail the advantages of various ones of the qualifications desirable for each one. The quality and amount of electrical education that is desirable or necessary for the person depend very largely upon the work he expects to do. A university course is not necessary for certain lines of work. The demand for electrical engineers with a regular university training is comparatively limited, as is also the number of students ready to obtain such a preparation.

It is frequently suggested that men are making a great success in electrical work who have never been collegians and whose only schooling has been that of business and practical work. It is true that they make a success, but it is also true that the same men would have done

much more if they had added a thorough training to their other attainments. The secret of their success without a college education is that they have an abundance of push, common sense and the faculty of using the results of other people's knowledge. It is an undeniable fact that a great majority of the men at the head of electrical progress are college men. It is notably the case in alternating current work, where there is hardly an exception. The men who boast that they never went to college and ridicule the green graduates who have not yet had time to tone theory with practice are themselves reaping the benefits of the labors of trained scientific investigators and making their own living by it.

The young graduate has not finished his education. The technical course does not aim to fit a person for any one position, nor to develop him into a full-fledged engineer, but to give him a training in general theory and fundamental principles with a general idea of methods and purposes in commercial practice. He is given the tools for work, but he must learn the applied part by actual experience. For this purpose it is highly desirable that he spend some time in commercial work during his technical course.

If two or three of the long summer vacations are spent in electric light or power stations, in repair shops or factories or in telephone or telegraph exchanges, he will learn to appreciate the practical bearings of what is taught in the class room and laboratory, and will derive much more value therefrom. Above all he should cultivate his common sense and reasoning powers. Students are likely to acquire the habit of accepting everything that is in the technical papers or text books and thereby are often led into serious error. One should use one's common sense, train it, and if one finds one has but little, then electrical pursuits should be left aside.

The History and Development of Cooking by Gas

[A paper read by Mr. A. Main, of Glasgow, before the North of Ireland Association of Gas Managers.]

Forty-three years ago, in 1850, there was a somewhat remarkable scene witnessed in the ancient city of Exeter—an incident having for its central figure a very remarkable man, and notable in itself as being somewhat prophetic of a new order of things in one great department of human economy. In the center of a large crowd, the object of a good deal of jeering ridicule, stood a French *chef*. The Royal Agricultural Society was holding its annual meeting in Exeter, and this French *chef* had been engaged to superintend the cooking of the banquet.

He tells us that he determined to signalize the occasion by serving a new dish—viz, "A baron and saddleback of beef *a la* Magna Charta," weighing 535 lbs., or close upon 5 cwt. To roast such a joint at one time was a difficult thing to do, on account of the immense fire required; and former attempts, it seems, had not always been successful. A crowd gathered, in expectation of seeing a large bonfire lighted; but, to every one's surprise, all that was visible was an oven 6 feet 6 inches by 3 feet 3 inches, constructed roughly with a few bricks and a few sheets of iron. Into this temporary oven were introduced 216 very small jets of gas, through pipes ½ inch diameter. The on-lookers were incredulous, saying it was impossible so enormous a joint could be roasted by such means. But, after eight hours' roasting, it was found to be thoroughly cooked, at a cost (in those days of dear gas) of less than 5s., and it was carried on the shoulders of eight men through the streets of Exeter, preceded by a band playing "The Roast Beef of Old England," and followed by a crowd of some thousands. The hero of this animated scene was none other than the illustrious Alexis Soyer, probably the greatest master of the culinary art ever sent to our shores by France—that country of *la grande cuisine*. Soyer was *chef* to the Reform Club in London, and superintended all the great banquets of his day. He wrote some of the most interesting and fascinating works on cookery which we possess; notably his "Pantropheon"—a book of immense research on the subjects of food and cookery. Soyer tells us, speaking nearly half a century ago, that "he knew well the power and efficacy of gas for cooking."

Such is the first authentic record I can find of the use of gas for cooking purposes. In the following year (1851), at the great Exhibition in London, a patent gas cooking oven was exhibited by Alexander Graham, of Glasgow. This oven was fitted with luminous jets inside, the gas issuing from three small needle holes in each burner, while an iron boiling ring on the top was provided with similar jets, bored with four holes instead of three. As yet the bunsen burner had not been used. Mr. Graham was a well known and highly respected hotel proprietor and *restaurateur* in Glasgow, and a number of his *confreres* in his city and neighborhood were induced to follow his example in the use of gas for roasting. Mr. Graham made and sold a limited number of cookers for hotels and restaurants; but as yet the use of gas ovens for domestic purposes was practically unknown. Mr. Graham was certainly one of the pioneers of gas cookery. About this period we find gas cookers made by Mr. Davis, of Bath; and various makers appeared in London, Birmingham, Leicester, etc.

Very strong prejudices had to be encountered and overcome before gas obtained anything like a popular hold on the ordinary consumer, and thoroughly established itself as an indispensable auxiliary in every first-class kitchen. The average cook, who, with perfect equanimity, exposed a chop or steak to the fumes of a coke or a coal fire, shuddered at the thought of a joint being exposed to the same fuel in a purified state, as received from the gas works. Only those conversant with the trade in its early stages can recall the extraordinary and unreasonable prejudices which gas had to overcome—prejudices founded, of course, on ignorance, but nevertheless powerful and obstinate.

Now-a days, when the use of gas as fuel is so universal, we are apt to forget that the trade has only assumed definite and popular form within the last dozen years. It was extremely difficult to sell gas cookers to ordinary consumers; and the trade would never have assumed its present great dimensions but for the fact that gas companies and corporations, alarmed by the first electric light scare, took the matter in hand and turned their attention seriously to the subject of the value of coal gas as a fuel, and began to hire out the cookers at small rentals. Foremost among these, if not the first, was Mr. Alfred Colson, of Leicester, who entered into the matter with great spirit, and published a very valuable little pamphlet, entitled "The Economy and other Advantages of Cooking by Gas." This pamphlet was circulated in large numbers, and was a powerful means of educating popular opinion on the subject. Mr. Colson began by acknowledging that "the want of knowledge and appreciation of gas as a fuel on the part of the public had been largely due to the apathy displayed by gas companies generally in bringing before the notice of their consumers the merits of a commodity of which they were the producers." At the same time, the leading medical journal, the *Lancet*, began to advocate the use of gas for cooking and heating; and this materially helped the extended use of gas for these purposes.

In 1882, a very valuable contribution was made to the subject by Dr. Stevenson Macadam, of Edinburgh, in a lecture delivered to the North British Association of Gas Managers (and published afterwards in pamphlet form), on "The Sanitary Aspects of Cooking and Heating by Coal Gas." By careful and prolonged experiment with the cookers of three leading makers, Dr. Macadam arrived at some very important and definite conclusions. One of these was that the cooking of meat in the gas-oven yielded a larger return of cooked meat than in the coal-oven. It was found (and this has since been amply demonstrated by other experiments) that, while a joint cooked in the coal-oven lost 40 per cent. of its weight in the process of cooking, the same joint would lose only 25 per cent. of its weight in the gas oven. "To a large extent," says Dr. Macadam, "the difference of 15 per cent. is due to the meat being constantly surrounded by an aqueous vapor derived from the combustion of the gas. The influence of this moist atmosphere not only kept the meat more moist, but hindered the escape and evaporation of the juices; retaining the osmazome or flavoring matter, so that the meat when thoroughly done is more juicy and more palatable, and yet free from those alkaloidal bodies produced during the confined cooking of meat in the coal oven, which are more or less hurtful and even poisonous." Dr. Macadam further pointed out that the meat, being more juicy, is also more easily digested. This testimony, on the part of so high an authority, had a most favorable and beneficial effect in dispelling the remaining prejudices against gas cookery, and very soon rapid strides were made in the direction of improved construction of gas stoves, and in the number of corporations and companies who hired them to their consumers.

Within the last ten years, the development of gas cookery has been very extraordinary. Exhibitions of gas appliances have been held all over the country, combined with free cookery lectures; and public opinion has been largely educated by this means. One aspect of the question is worthy of notice. We must all be conscious of the immense strides that have been made during the present generation in familiarizing the art of cookery in our country. After years of astonishing neglect, our Education Department at last awoke to the fact that cookery ought to form part of every woman's education; and during recent years County Councils have also expended large sums on this most important department of education. Schools of cookery have arisen in all the leading centers; and our Board Schools are now equipped with the necessary apparatus for teaching this important branch of domestic

economy. It can scarcely have escaped the notice of observant spectators that this vital, but quiet, social revolution could not have attained its present dimensions but for the fortuitous circumstance of a new and much improved method of cooking—the introduction of the gas oven.

Bound up with this question is the pressing and important matter of the solution of the smoke problem and the purification of the air of our large towns. Our rural population keeps crowding into the city; and as, year by year, the great towns increase in size, the smoke question has become one of the most pressing problems of the day. The question must sooner or later be faced and solved. Various solutions have been offered, but none so satisfactory as that which suggests the use of gaseous fuel, both for cooking and heating. Dealing with this subject a few years ago, the late Sir Wm. Siemens said: "I hold that it is almost barbarous to use raw coal for any purpose, and that the time will come when all our fuel will be separated into its two constituents before reaching our factories or our domestic hearths. Such a measure would not only furnish us with the complete solution of the smoke question, but would be of great value as a money-saving expedient."

The following figures will be of practical value to managers of works where the system of hiring is in contemplation. They have been kindly supplied to me by Mr. W. R. Chester, of Nottingham:

Some Statistics as to the Purchase, Hire and Cost of Maintenance of Gas Cooking Stoves in Nottingham.

The average net cost of 1,511 stoves purchased up to the end of the year 1891 was £4 0s. 3d. each.

The basis upon which the rental is fixed is as follows: 10 per cent. is deducted from the list price; and the rental is 10 per cent. on the balance. For example, a stove costs £5, or 100s.; 10 per cent. off = 90s., 10 per cent. on 90s. = 9s. per annum, or 2s. 3d. per quarter. This is about 13½ per cent. on the net cost.

The average period for which a stove remains fixed is five years. The average cost of fixing, which is all done free of cost to the consumer, providing he rents a stove for a whole year, and not more than 30 feet of pipe are required for fixing, is 6s. 6d. per stove. The average cost of removing, cleaning and repairing a stove is 6s. 6d.

The actual rent received for 1,511 stoves on hire is £684, or 9s. each per annum. The average charge on each stove in use is as follows:

Cost of fixing, one fifth of 6s. 4d	1s. 3.0d.
Removing, cleaning and repairing.....	1 10.7
Refixing repaired stoves.....	0 4.4
Inspection and attendance on complaints.....	1 5.3
Proportion of show room expenses.....	1 4.6
Total annual charge per stove in use.....	6s. 4.0d.

The excess of rental over expenses is thus 2s. 8d. per annum.

In ten years only five stoves have had to be renewed. The net rental at present received—2s. 8d. per stove per annum—will, at 5 per cent. compound interest, provide a renewal fund to replace all the stoves once in 18½ years. The life of a stove, based on 10 years' experience, will not be less than 18 or 20 years; and therefore the present rental charged will be sufficient to provide against any actual loss on the business, and the profit on the gas consumed is therefore all clear gain.

The average increase in the consumption of gas where 385 stoves have been fixed is 15,438 cubic feet per stove for the first clear year. The gas used for cooking purposes gives an increase to the former consumption of about 4 per cent.

Discussion.

The President said he was sure they were much obliged to Mr. Main for his most interesting and instructive paper. The development of gas cookery was a question in which they were all very much interested; and the more attention that was given to it, the better. There could be no doubt that the sale of gas in the daytime, especially during the summer months, was very valuable. They knew that all their works preferred to have gas made in the daytime. The extra cost required to produce the gas necessary for cookery was, therefore, simply the cost of the coal, less the residual products; and a very considerable margin was thus left. He had often thought that the advantages attending gas cookery were not known, as they ought to be, by gas managers themselves; and this accounted for their apparent apathy in the matter. They ought, as gas managers, to make themselves cognizant of all these advantages; and the only way they could do this was by introducing the stoves into their own dwelling houses. Then, when they had the information themselves, it was their bounden duty to make it known to the public. Mr. Main had referred to the prejudices existing against gas cooking. In his (the President's) opinion, these prejudices still existed to a very alarming extent. It was a great pity that it should be so; but this very existence should make them the more ready to endeavor to inform the public mind on the subject. Mr. Main was evidently unaware of the fact that it was not considered necessary in Ireland that cookery should be an essential branch of the education of girls; but he (the President) hoped the time would soon come when this condition of things would be changed. There was another difficulty connected with the introduction of gas stoves into houses—that was the servant girl difficulty, which most of them had experienced. However, they had partially surmounted this obstacle by fitting on lock taps; and if any of the members intended going in for the hiring out of gas stoves, he would strongly urge them to adopt this course.

Mr. E. Stears (Lisburn) remarked that, as far as his experience went, gas cooking stoves had given the greatest possible satisfaction. He had been informed that in Manchester no charge was made for the stoves; but he did not consider that they were so far advanced in Ireland as there.

Mr. J. T. Clark (Edinburgh) inquired if the tap the President referred to was in charge of the domestic or her mistress?

The President replied that it was intended to be in charge of the latter.

Mr. Ransome (Warrington), alluding to the observations of Mr. Stears, said that, from his own personal experience, the stoves were not let out even in Manchester free of cost.

The Secretary said that his experience with regard to gas heating stoves was not a very encouraging one. He had them introduced into his own house, though he did not believe in them altogether, for they were too expensive for common use. When people had consulted him with regard to them, he had made a rule of advising them that, if they were prepared to pay for a luxury, they ought to purchase the stove outright. The gas heating stove was very useful in an office or room, where its use conduced to the cleanliness of the books and papers contained in it. He thought, however, that every one who could should pay to have a gas cooker. The domestic servant difficulty was certainly a difficulty which was much experienced in the city he came from; for he thought that, in this respect, Armagh was perhaps more peculiarly situated than some other towns. Many of the ladies there did very little in the kitchen themselves; and the expense which was thus entailed by the negligent use of gas stoves by servants was really monstrous. In a great many cases the cost had turned out to be so great that the ladies had refused absolutely to have anything further to do with the stoves. For himself, he had connected with his gas stove a meter by which he was able to accurately measure the amount of gas consumed. He strongly advocated the use of gas bath heaters which were simple and effective; and he thought that householders should be encouraged to use them.

Mr. W. Ivison Macadam (Edinburgh) said he had no experience as a gas manager, but as a gas consumer he had experience of a cooker which he had introduced into his own house. The stove did its work thoroughly well; but——the "but" was the servant girl (laughter). He thought that if Mr. Main would adopt on his cookers some automatic principle which would limit the expenditure of gas to the period during which the stove was actually being used—and this should certainly not be difficult—a great step would have been made in advance. As to the use of bath heaters, he was of opinion that it would not be advisable to introduce many of them, as people now wanted something more than hot water plunge baths. Then, with regard to gas fires, there was no doubt that they were good for offices. In his own library he had found a gas heater to be a great convenience, and a saving as far as the binding of books was concerned; while it had proved a decided source of comfort to him in his bedroom.

Mr. Clarke said he had in use an automatic invention of his own by which the consumption of gas in his cooking stove was regulated.

The President said there was not a single one present but would admit that gas appliances were very efficient; but what they were more anxious about was the development of their gas business. Five years ago there was not a gas stove in Coleraine; and at the present time there were something like 300 or 400. This result was achieved by simply keeping "pegging away;" and, as a consequence, they had already increased their business by 10 per cent., which was mainly accounted for by the introduction of gas stoves. They were thus enabled to sell gas in Coleraine cheaper than they had ever done before, and they hoped to have another reduction soon.

Mr. Main, replying to the various speakers, said, with regard to the lock-tap, that it was a very admirable thing, and as a firm they had advocated the use of such an appliance for years, so as to prevent as far as possible the waste of gas. It was very easily fitted, and it was very effective when properly locked. With reference to Mr. Macadam's remarks about an automatic gas supply controller, such a device was in

existence, and a very good thing it was. But the trouble of all automatic arrangements was that they were so easily put out of order. They were then worse than useless; in fact, their last stage was worse than the first. If a thorough automatic arrangement could be devised, there was no doubt that it would be a very good thing. Anent hot water baths, if they wished a spray bath it could only be accomplished by having a high-pressure boiler; but he thought it ought to be clearly understood, as one of the most important facts in connection with the development of the gas stove business, that there was not the slightest difficulty in supplying a very simple and inexpensive arrangement to give water under pressure. A small boiler standing beside a cooker or in any other convenient place, could have a flow and return pipe connected with an ordinary high-pressure tank. This was all that was necessary. With regard to the use of gas fires, he had always advocated putting them in bedrooms and drawing-rooms—where proper economy could be exercised; but he had generally advised people against them for other rooms.

Magnesia Bricks.

Mr. C. Bischof, in a communication to the British Institution of Civil Engineers on this subject, says that for the manufacture of magnesia bricks the material most in favor at present is the magnesite of the Veitschthal, in Styria, which, although less pure considered as a source of magnesia than the same mineral from the island of Eubœa, in the Greek Archipelago, has the property of fritting at a high temperature without melting. This is due to the presence of iron and, probably, aluminum in small quantity. The composition of the two substances, both in the natural and burnt states, is as follows:

Magnesite.	Styrian. Per Cent.	Greek. Per Cent.
Carbonate of magnesia	90.0 to 96.0	94.46
" " lime	0.5 to 2.0	4.49
" " iron	3.0 to 6.0	FeO 0.08
Silica	1.0	0.52
Manganous oxide	0.5	Water 0.54
Burnt Magnesite.		
Magnesia	77.6	82.46—95.36
Lime	7.3	0.83—10.92
Alumina and ferric oxide	13.0	0.56— 3.54
Silica	1.2	0.73— 7.98

The calcination may be effected in cupolas with a silicious lining in reverberatory furnaces, or, best, in highly heated gas kilns, the nature of the product varying with the amount of heat to which it is subjected. At a red heat magnesium carbonate is decomposed into carbonic acid and caustic magnesia, which resembles lime in becoming hydrated and recarbonated when exposed to the air, and possesses a certain plasticity, so that it can be molded when subjected to a heavy pressure. By long-continued or stronger heating the material becomes dead burnt, giving a form of magnesia of high density, sp. gr. 3.8, as compared with 3.0 in the plastic form, which is perfectly unalterable in the air but entirely devoid of plasticity. According to Schlossing, a mixture of two volumes of dead-burnt with one of plastic magnesia can be molded into bricks which contract but little in firing. Other binding materials that have been used are clay up to 10 or 15 per cent., gas tar, perfectly freed from water, soda, silica, vinegar as a solution of magnesium acetate which is readily decomposed by heat, and carbolates of alkalies or lime. Among magnesium compounds a weak solution of magnesium chloride may also be used. For setting the bricks lightly burnt, caustic magnesia, with a small proportion of silica to render it less refractory, is recommended. The strength of the bricks may be increased by adding iron, either as oxide or silicate. If a porous product is required, sawdust or starch may be added to the mixture. When dead burnt magnesia is used alone, soda is said to be the best binding material.

At Brieg, in Silesia, where the production of magnesia bricks was first carried out on the large scale from the magnesia of Frankenstein, a mixture of dead burnt with a small proportion of caustic magnesia, crushed fine by roller mills, was molded with magnesium chloride solution into bricks which were subjected to a pressure of 110 atmospheres, so that the pressure upon an ordinary brick amounted to 50 tons. After eight days' careful drying in the air, they were placed in the chambers of a Mendheim annular gas kiln in piles only 6 or 7 brick high, and subjected to a very high temperature; the firing being controlled by pyrometric cones made of felspar and fireclay. These bricks are said to have contained 98 per cent. of magnesia, but their cost was too great to create any very special demand, and the manufacture has been given up. According to Lezius the average composition of magnesia bricks in use is about—magnesia 80.9, silica 4.8, alumina 1.6, ferric oxide 6.8, lime 6.5 per cent. When a magnesia brick is laid upon a firebrick bed, no action takes place below about 1,600 C., but above that point combination takes place with the formation of a fluid grey slag, which rapidly perforates the firebrick.

When a bed of pure alumina is used the resistance is somewhat greater, but not much. The resistance to slagging from the ash of fuel is only about one-half that of a good fireclay brick. Upon a coke or gas carbon bed pure magnesia may be heated higher than the melting point of platinum without showing the slightest sign of fusion; but, in the presence of other substances, fusible combinations are more or less readily formed. The fluxing power of these substances is as follows in ascending order: Alumina, lime, ferric oxide, silica and phosphoric acid, the latter substance being far more corrosive in effect than silica. A mixture of pure alumina and magnesia in equal parts is infusible at the welding point of malleable iron, but the combination is rendered easy by the presence of a third oxide.

In addition to their principal application in the basic open hearth furnace and converter, magnesia bricks have been successfully used for lining kilns for cement makings and in burning strontia for sugar works, and also in lead and antimony smelting works, as they remain perfectly tight when exposed to molten lead, which readily permeates ordinary firebricks.

Foundations.

A writer in *Engineering* remarks that probably of all the various systems employed for putting in the foundations of bridges, the pneumatic method is the least exposed to accidental interruptions. Even when the sight can be laid bare by means of a cofferdam, serious leaks may occur at any moment, and there is also the risk of floods, so that the engineer in charge has an anxious time of it till the masonry has been raised above water level. By suitable precautions these risks can, no doubt, be minimised, and, where the water is comparatively shallow, and one is not tied for room, the use of a cofferdam will usually be the most economical plan that can be adopted. Much of the trouble experienced with such works is due to an insufficient allowance of room inside the dam. The inside dimensions should be, where possible, at least 6 feet more than the extreme dimensions of the foundation plus an amount equal to depth of excavation below the river bed. Where as much space as this cannot be afforded, it is a good plan, after pumping the dam out, to drive stout sheet piling about the exact site of the foundation. By means of walings and poling boards, the foundation can then be sunk to firm ground without fear of slips, which might endanger the safety of the dam. In such cases the foundation up to the river bed is conveniently made entirely of concrete, as then there is no necessity to remove the timbering supporting the sheet piling, and it may accordingly be left in place.

Pile foundations are also often economical, but too frequently the piles are ruined by overdriving. It is far better to drive such piles to a moderate penetration, and use more of them. The cost of the extra piles will be largely made up by the less cost of driving. The practice of driving them to "refusal" cannot, as a rule, be too strongly deprecated, as a bass broom makes a poor sort of column, however efficient it may be as a sweeping implement. When drawn, as they occasionally are, over-driven piles are found to be splint, bent, their ends crushed, and to have cast their shoes. In soft strata piles will drive straighter and easier if they are not pointed or shoed. When brought to a point, as is usual, it is impossible to keep them straight, should a boulder or tree trunk be encountered when driving. In such cases, unless the point strikes the obstruction perfectly fair and square, it is sure to be deflected, whereas with a square-ended pile there is less risk of this. In compact sand it is impossible to drive piles to any depth by blows, but by the use of the water-jet they can easily be sunk any required distance. The safe load on piles under these conditions is difficult to estimate. They are held in place partly by the friction of the sand against their sides, and partly by the upward pressure at the point. If we adopt Rankine's theory of earth pressure, the resistance of the pile should then be

$$R = A\,w\,x\left(\frac{1+\sin o}{1-\sin o}\right)^2 + \frac{S\,f\,w\,x}{2}\left(\frac{1-\sin o}{1+\sin o}\right)$$

where A = effective area of cross-section of pile.
w = weight per cubic foot of material into which it is driven.
x = depth in feet to which it is driven.
o = angle of repose of the material.
S = surface of pile exposed to friction.
f = coefficient of friction.

The first term is that due to upward pressure on the bottom of the pile and denotes the load which can be placed on any area without settlement, when the surrounding area is loaded with $w\,x$ tons per square foot. If this load is exceeded, the foundation sinks and the surrounding earth rises. In the case of a pile, however, the friction of the earth against the sides of the pile tends to prevent this rise of the surrounding material, and the practical effect is to increase the area of the base of the foundation. In addition to this, the friction on the sides tends of course to support the pile directly, as indicated by the second term of the above formula.

The most uncertain element in this formula is the angle of repose o. The less this is, the greater is the frictional resistance of the pile, and the greater the effective area of the pile, but the smaller is the factor

$$\left(\frac{1+\sin o}{1-\sin o}\right)^2$$

These two considerations tend more or less to balance one another. The whole question is, however, beset with difficulties, but we do know that the resistance of piles driven into soft strata is often very remarkable. Thus, piles driven 30 feet into such soft material that they went down from 10 to 20 inches at the final blow, have safely carried the heaviest railway traffic for years, the load amounting to about 7 or 8 tons per pile. In fact, on testing some of these piles after they had been in place some months, they could not be moved further with the heaviest drivers available. Had the load been calculated from the last penetration of the pile when originally driven, the piles would have been loaded with considerably less than one ton.

From these considerations it is obviously in important work advisable to determine the true bearing power of a few piles by direct loading, the experiment being made some days, or, better still, some weeks after the driving.

Where the strata is fairly firm, this great increase in bearing power does not seem to take place, and the safe load can be calculated from the penetrations in the original driving.

The great danger to which pile foundations are subject is scour. One method of protecting them against this is to sink a cast or wrought iron cylinder round them to a depth below which no scour is to be feared. The space between the piles and the cylinder is filled up with concrete, and the group is thus effectively braced together. This plan is often cheaper than sinking the whole cylinder to a firm stratum by dredging. The piers thus formed are usually small in diameter, and have not much transverse stability. Hence for railroad bridges, where considerable longitudinal forces may come into play by the action of the brakes, they should be adopted with caution. In the case of ordinary road bridges, this point is of less importance, as such bridges are not exposed to longitudinal strains. The principal transverse stresses on the piers are then due to wind pressure, which is easily provided for by bracing a couple of the cylinders together in the usual way. These cylinder piers have very considerable advantages in many cases, though in this country they are not supported on piling, but are carried down to a firm stratum by dredging. If obstructions are met with, a diver can be sent down, or if the matter is more serious, it is easy to close in the open top and complete the work on the pneumatic system.

Where larger piers are required in fresh water, there is much to be said in favor of the American system of building the under water portion of the pier largely of wood. Much ingenuity has been expended, both here and on the Continent, with a view to reducing the amount of metal left permanently in large piers sunk by the pneumatic or Indian well system.

All the iron left in such piers is practically dead loss. Its supporting power is not taken into account, as it is necessary to fill the caissons with concrete, practically as much of this being required as if the metal were absent. True, it protects the iron inside it for very many years from injury, but it can hardly be expected to do so indefinitely, as in the long run rust must tell its tale. Timber, on the other hand, is practically indestructible when kept completely immersed in fresh water. It softens somewhat, it is true, but its strength remains ample for any load likely to come on it. As regards speed and ease of construction, there is no comparison between the use of iron and wood. The latter is incontestably superior. The material is brought to the site in convenient sizes and worked up into the pier with practically no other tools than augers and saws. Stone or concrete is built up with the wood, so that the buoyancy may not be too great, and when ready it is floated out to its site, without any such special arrangements as are needed with iron. When there it is grounded by weighting it with gravel or concrete, and the remainder of the sinking completed by the open dredging or pneumatic methods.

Unemployed Labor.

The *Iron Age*, in an editorial reference to some phases of the labor problem in this country, says that in the shifting phases of business life the American people are quite frequently confronted with problems of almost national importance, which must be solved in some way. We seem to have more of these important questions coming up than any other nation, due probably to the great extent of the country, the magnitude of its business interests and the disposition of the people to push forward recklessly in business enterprises. Chances are readily taken which would not be seriously considered by conservative British, German or French business men. The siren song that "this country is so strong that nothing can shake its prosperity" seems to have impressed itself so thoroughly on the people who have been taught to sing it that they think it applies equally well to individual cases. We are now finding that some of these problems which have been solved in the past have been disposed of in very shiftless fashion. Their effects are being seriously felt. Among these effects are some new problems which demand very early and efficient treatment. The most important of these consequential questions is, What shall be done with the unemployed? Their number appears to be steadily increasing, and in some cities demonstrations have been made which excite apprehension among the conservators of the peace. It has been many years since the people of the United States have seen daily processions of the unemployed marching through the streets in order to excite sympathy for their hapless condition. But these processions are now becoming quite a feature of city life, and much as they may be deplored and condemned as leading to turbulence, they certainly compel notice to be taken of the fact that workmen are idle and their families need bread.

The committees of citizens that have been organized in some localities to devise methods of alleviating the distress seem to be unable to suggest practicable measures. Public improvements, which will employ many men, are advocated by those who believe that States and municipalities should undertake the work of caring for these unfortunates. They overlook the important fact that retrenchment in such times as these must be adopted by State and municipal governments, as it is difficult for property owners to raise their customary taxes, and are therefore in no position to carry additional burdens of taxation. Besides, wholesale measures of relief, if adopted by any community, would merely attract large numbers of idle men from other places to share in such privileges. If a plan of this kind could be adopted, it would have to be done in concert by almost every State and every community in order that the burden might be equally borne. Charitably disposed persons are finding out for themselves that they cannot restrict their charity to the poor of their own immediate districts, but that applicants for relief will flock from remote distances as soon as the welcome news of the general distribution of alms is heard. Such news travels very fast. It is probable, however, that while citizens' committees are discussing how this sad condition of the poor can be best alleviated, individuals will be hard at work doing the best they can on their own account to help those who come immediately under their observation.

From practical experience the impression is forced upon us that much of the distress now existing among workingmen can be speedily terminated if they should be more reasonable with regard to wages. Improvements of various kinds would be undertaken by men of capital if they had the inducement of low cost offered them. They have faith in the future, look forward to the time when every wheel will again be in motion, and believe that the country will need enlarged facilities whenever the renewal of prosperty occurs. Plenty of such preparatory work would be undertaken even now if it could be done cheaply. Building would also be much more active. Yet estimates of cost show scarcely any shrinkage as compared with a year ago. Materials were so low then that they could hardly be expected to go lower, but some shrinkage is expected in labor in view of the large number of persons unemployed and the disorganized financial conditions. It would seem that under such circumstances as these any standard of wages would be disregarded, and that men with starving families would work 10 or 12 hours a day to get enough to feed and shelter them if the opportunity presented itself. This would not be the forcing of wages down by capitalists, but the selling of labor at the best price it will bring. When there is no demand for any commodity, and the market must be forced, a sacrifice sale is made. This is the time when reasonable men must make sacrifices of their labor if labor is all they have to sell. It is foolish to talk of "the regular scale," or "the regular wages," or "the regular hours," when such conditions absolutely prevent employment. Nothing is "regular" now. The times are out of joint, and men should drive

the best bargain they can, making sure, however, that they are not setting their terms so high that they scare off the other party.

The elements of recuperation are with us in abundance, and only a little time is needed to allow them to grow. Business will not always be depressed, and if wages generally were to be cut in two, as compared with last year, they would not remain permanently on such a basis. The return of prosperity, which will bring with it a renewed demand for labor, will advance the price of that labor as well as of commodities. It is fortunate, in one way, that the convulsion in trade came when it did—in the spring instead of the autumn. Poverty is more endurable in the summer than in the winter. And there is more than a chance, also, that the turn of the season in the fall will bring an increase in business. The reaction may not be great enough to give everybody employment, or to restore the wonted buoyancy to all branches of trade, but it may be sufficiently so to permit many idle enterprises to resume. Their resumption will undoubtedly be greatly helped if idle workingmen can be induced to consider "half a loaf better than no bread."

Output of Dynamos.

In the early days of electric lighting a machine that would run, say 200 or 300 incandescent lamps, says Mr. Arthur F. Guy, in the London *Electrical Engineer*, was considered to be a large-sized one, but as time went on, their output became greater and greater, until now, when the electric light may be said to be solidly fixed on sound foundations, for lighting, we have machines built for running 10,000 incandescent lamps of 16-candle power; and for traction machines of 2,000 e. h. p., or 1,500 units. The Westinghouse Company has put down 12 alternators for running the lights of the Chicago Exhibition, each capable of running 15,000 lamps of 16-candle power; the armatures of these enormous machines alone weigh 18¼ tons each. These alternators are believed to be the largest yet run by belting, and it may not be long before such sizes as these, and in all probability larger than these, will be used for generating electricity in central stations. With arc lighting machines working at a constant current, there is a limiting factor, which is very difficult to get over, and that is the pressure. Every additional arc lamp in the circuit signifies another 50 volts pressure at the dynamo terminals. The largest continuous-current arc lighters run 60 lamps in series, and therefore they have a working pressure of 3,000 volts. It is very difficult to insulate armatures of continuous-current machines working above this pressure, the high pressure being ruinous to the insulation. In addition to the inability of the armature coils to withstand such pressures, the greatest care must be exercised by trimmers and circuit men in handling the lamps, wires, etc. Since a full arc lamp takes about 10 amperes, and absorbs a pressure of 50 volts or so, therefore 60 lamps in series will require 3,000 volts pressure to maintain a current of 10 amperes through the lot, so that a 60-arc lighter has an output of 30 kilowatts, or units, each lamp taking half a unit.

The output of the electric machines is reckoned in kilowatts, often called for shortness, units, because the kilowatt is the unit of electric power. This expresses the power of the machine or *rate of work* done, and the word unit applied as above must not be confounded with a Board of Trade Supply unit, which is often called a unit for shortness—this latter signifies a kilowatt of electric power working for the space of one hour, and producing a kilowatt hour of electric energy, or *quantity of work* done.

There are many commercial data concerning dynamos that are very interesting, and, what is more, extremely instructive. Among such are: Weight, floor space, speed, output, etc., of machines compared with their first cost; and the different pattern machines can be compared, when figures can be worked out, given such data as number of watts a certain dynamo can develop per pound dead weight, the machine compared being of the same, or almost the same, output, speed, type and such matters; then machines of greater sizes can be similarly compared. Another interesting matter to know is the number of watts per square foot of floor space machines can give for various sizes and speeds. A third matter is the cost per unit for various sizes and speeds. For all the above, curves can be plotted, and it is surprising what a quantity of suggestive information can be gathered from them.

Methods for Preventing Rust in Exposed Ironwork.

Engineering Magazine notes that efforts aimed at the prevention of rust in ironwork exposed to the action of air and moisture have resulted in the invention of several processes more or less effective for the purpose. It has been found that the formation of a coating of magnetic oxide is, under many circumstances, a considerable protection against the formation of the sesquioxide, which is what is commonly called iron rust. The protecting oxide is formed when iron is exposed for a sufficient length of time to the action of highly superheated steam. The renaissance of art in wrought iron work now in active development in the United States renders any process that will afford more ample protection of special importance at this time.

A large establishment has been organized in the city of Brooklyn, N. Y., for the purpose of rust-proofing under what is called the Gesner patent process. This process differs radically from any other that has preceded it. Instead of substituting one oxide as a protection against the formation of another, this process is claimed to transform the surface into a peculiar combination of carbon, iron and hydrogen, which is permanently proof against the action of air and moisture. Some other peculiar claims are made for this process. It is stated that it renders the metal treated by it capable of remaining proof against rust when exposed to the action of sea water, earth, or steam condensing upon the surface, the latter being, as is well known, a most effective agent in corroding polished surfaces. It is claimed, in addition, for this new process that it does not increase the dimensions of the article treated, and that the iron is strengthened rather than weakened by the treatment. In fact, some extraordinary claims for increase of strength have been published which it is preferred to not repeat until further opportunity is afforded for their verification.

Still another method of preserving iron, which is equally applicable to zinc and copper, as well as to alloys of the two latter metals, introduced by M. Ghest, of Paris, France, is attracting attention in Europe. The preservation is accomplished by the application of a new composition, which is spread upon the surface by the use of a brush like ordinary paint, and which may be made the basis for subsequent coats of any of the common paints. Thus, after the protective composition is applied, the surface may be ornamented by painting and gilding in the same manner as heretofore. The formula for this composition has not been made public, but the accounts of its properties indicate that, while its preservative action is extraordinary, rendering the metals proof against the action of the strongest acids, it has remarkable flexibility and elasticity, so that metal sheets covered with it may be bent, twisted, or torn asunder without cracking the coating except at the part where the metal divides. It is said that a brass sheet to which this composition had been applied was subjected to the severe test of first being placed in a sewer for three months, and then placed in a bath of strong nitric acid, without any perceptible action either upon the metal itself or upon the composition.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE Coney Island Fuel, Gas and Light Company has been authorized by the State to have its affairs governed by five Directors instead of three.

MR. A. T. DICKINSON, Superintendent of the Rockville (Conn.) Gas and Electric Light Company, was married last Tuesday to Miss S. Belle Hodge. Good luck to them.

WE are indebted to "H. S. J.," of Boston, Mass., for the following: "*From Report of Massachusetts Gas and Electric Light Commission.—Electric Light Companies.*—Franklin L. Pope, the distinguished electrical expert, continues to point out, in the pages of the *Engineering Magazine*, that the prevalent craze for the construction of electrical street railways is leading to the exploitation of them in many localities where there is no chance of their ever paying remunerative investments. There has been excessive development in the electrical field in other directions, as well. Of the 84 companies engaged in supplying electrical light and power in Massachusetts in 1892, only 16 have been able to earn dividends of 6 per cent. or more, while 61 have paid no dividends at all. Most of the smaller companies have already overloaded their plants, and are now confronted with the serious question whether it is worth while to add to their already unprofitable investment in order to accommodate new custom. Like the English sportsman in the jungles of India who had the tiger by the tail, they do not know whether it is best to hold on or let go. If they raise the rate to a paying point, which would probably necessitate an advance of 50 per cent. on the present figure, not only will they be denounced as conscienceless extortionists and monopolists, but their customers will in too many instances revert to their old-time habits of burning kerosene and going to bed at 9 o'clock. That the situation is a sufficiently serious one, is shown by the fact that more than one million dollars has been invested

in electric lighting plants in various Massachusetts towns on which the net earnings at the present time, leaving repairs and renewals out of the question altogether, *do not exceed one per cent. per annum.* Yet the conditions of success and prosperity in this industry are, to say the least, *fully as favorable in Massachusetts as in any other section of the United States.* It is not difficult to foresee that there must ultimately be a severe check to the present electrical boom. An enormous amount of capital is being put into electrical enterprises of one kind and another which have no inherent possibilities of ultimate commercial success. The manfacture and sale of machinery and supplies for the equipment of all these non-paying electric light companies and electric railways make business lively and apparently prosperous for the time, but when the inevitable day of reckoning comes, it is much to be feared that the financial results will lead capitalists to entertain an ineradicable distrust of legitimate as well as illegitimate electrical enterprises—a consummation for many reasons greatly to be regretted.—Boston *Transcript*, Aug. 26, 1893." The other side of the picture, as shown by the report of the Commissioners in respect to the Gas Companies of the State is like this: In Massachusetts, for the year 1892, there were 68 Gas Companies doing business, of which 50 paid dividends averaging eight per cent. The average dividend for *all* the Gas Companies in the State—those that paid and those that made no return—would be 6 per cent. The total sales of gas in Massachusetts for 1892 were 325,000,000 cubic feet *more* than in 1891. The total sales for the past seven years are as follows:

Year Ending	Quantity.		
June 1, 1886	2,389	millions	cubic feet.
" 1887	2,522	"	"
" 1888	2,737	"	"
" 1889	2,933	"	"
" 1890	3,291	"	"
" 1891	3,902	"	"
" 1892	4,227	"	"

MR. HENRY C. SCHEEL, who is the General Sales Agent for Messrs. David E. Williams & Co., the miners and producers of the Madison gas coals, has, through an arrangement with the estate of the late M. Briggs, Esq., succeeded to the business formerly carried on under the firm name of M. Briggs & Co. The latter were prominent importers of Ince Hall and other English cannels, and they were also wholesalers of bituminous steam coals and gas coals. All correspondence in reference to the affairs of the transferred Company should be addressed to Mr. Henry C. Scheel, at his offices in the Washington Building, No. 1 Broadway, this city.

AT a meeting of the Directors of the New Bedford (Mass.) Gas and Edison Light Company, Mr. George R. Stetson was re elected President and Mr. Charles R. Price, Clerk. Appropriate resolutions on the death of the late Hon. William J. Rotch, who had been a Director in the Company, were adopted, ordered spread upon the records, and transmitted to the family.

AT an informal meeting of the Oakland (Cal.) City Council (held towards the last of August), the question of the illumination of the streets of that city for the ensuing year was definitely settled. For this purpose the sum of $64,000 was set aside, as against $59,508 appropriated last year, and 120 arcs of 2,000 candle power each are to be added to those already in service. As soon as the 120 new lights are in service, all but 100 of the present gas lamps (652 are now maintained) will be shut off. The number of electric lights at present in use is 279.

"OBSERVER" forwards the following about the gas service at North Attleboro, Mass.: "People frequently complain that the price of gas in North Attleboro is too high, but if they will compare it with that of other commodities, they will find that the proportion of increase holds about even. General living is a trifle high in town all along the line, and the price of gas as compared with other towns is not extortionate. If the Company could run its generating plant at the Falls to its full capacity, instead of one-third as at present, or if one Company could supply both the Attleboros, the price could be reduced. Some people have an idea that the Gas Commission is virtually under the control of the Companies, but such an idea is a most unwarranted one. The people always have a means of redress if they consider the price too high, and the State makes very strict regulations concerning the way in which gas companies shall transact business. The plant of the North Attleboro Gas Company is a very extended one, and the Superintendent tries to go over it about three times a week, from end to end, investigating complaints and attending to any business required. Such an extended line of pipe means a great deal of money invested. The jewelers use about two-thirds of the whole amount produced, so that the dull times means as much to the Company as to others. It is generally conceded that the service is a very good one."

AT a special town meeting, held at Windsor Locks, Conn., on August 28th, one matter that evoked a spirited discussion was the proposition to renew the contract for the public lighting. It was finally decided by the adoption of the following resolution: "*Voted*, That the Selectmen be allowed to make a contract with the Windsor Locks Electric Lighting Company for the proper lighting of the town at a cost not exceeding $15 per lamp per annum, lamps to be of 25 candle power each. Failing to make a contract with the Electric Light Company on the terms proposed, the Selectmen are to provide other methods for properly lighting the town."

SOME weeks ago, as was noted at the time in the JOURNAL, the Board of Supervisors of San Francisco passed a resolution calling upon the officials of the Gas and Electric Light Companies to furnish all possible information and data about their business, with receipts and expenditures, as the Board intimated that it intended to discuss the subject of regulating the charges for artificial light. When the subject came up in the Committee on Street Lights, Attorney Bishop and others appeared and stated on behalf of the corporations that the Board had no power to regulate charges, and could not so regulate the rates unless some new legislation was had on the subject. The matter was referred by the Committee to City and County Attorney Cresswell, who recently sent to the Supervisors a long opinion on the subject, in which he upholds the power of the Board to regulate charges for artificial light. The opinion is considered a very important one by the Supervisors, and when they resume business (they convene to day) some action will be taken that is likely to be of a radical character. Mr. Cresswell, referring to the letter of the Supervisors asking for information, says: "The part of section 33 of article IV. of the Constitution, having reference to the subject of the communication, is as follows: 'The Legislature shall pass laws for the regulation and limitation of the charges for services performed and commodities furnished by telegraph and gas corporations.' The part of section 11 of article XI., having reference to the communication, is as follows: 'In any city where there are no public works owned and controlled by the municipality for supplying the same with water or artificial light, any individual or any company duly incorporated for such purpose, under and by authority of the laws of this State, shall, under the direction of the Superintendent of Streets, or other official in control thereof, and under such general regulation as the municipality may prescribe for damages and indemnity for damages, have the privilege of using the streets and public thoroughfares thereof, and of laying down pipes and conduits therein and connections therewith, so far as may be necessary for introducing into and supplying such city and its inhabitants either with gas light or other illuminating light, or with fresh water for domestic and all other purposes, upon the condition that the municipal government shall have the right to regulate the charges thereof.' The City and County Attorney says that in this latter article of the Constitution the fixing of the water rates is provided for, and in no part does it remotely refer to the regulation of the charges for gas provided for in the first section quoted, section 33 of article IV. The first thing, therefore to inquire is whether there is a conflict between the two sections. After construing the two sections and applying the usual laws of legal construction, Attorney Cresswell concludes that the conflict between the two sections is only apparent, and that they must be read together, showing that the city has the right to regulate the charges for gas. The next inquiry considered is: Must the Legislature pass laws in aid of the municipal government before action can be taken by it in the exercise of the powers conferred by Section 19 of Article XI. In this opinion Attorney Cresswell says there is no need of such legislation, for these reasons: 'I am of the opinion that no act of the State Legislature is necessary to enable a municipal government to regulate the charges for artificial light furnished by individuals or companies organized under the laws of the State for that purpose to a municipality or the inhabitants thereof. The power having been granted the municipal government by Section 19 to regulate the charges for gas furnished by individuals or companies organized under the laws of the State to the municipality, every particular power necessary for the exercise of the right can be used by the municipal government. The municipal government can adopt a mode of procedure for the regulation of the charges for gas furnished under Section 19, and can use any means at its command in the exercise of the power. Upon whom must this duty devolve for the muicipality? When power is granted to a municipality which is not expressly conferred upon some particular department or officer, and is not of such a character that it must be exercised by some

particular department or officer, such power rests in the legislative department of the municipal government. The legislative department of the municipality of the city and county of San Francisco can pass an ordinance or resolution regulating the charges for gas furnished to the municipality or the inhabitants thereof by individuals or domestic corporations. It must not be forgotten that in 1878 the Legislature passed an act to regulate the quantity and standard illuminating power and price of gas in all cities within the State of California having a population of 100,000 or more. The constitution provides that all laws in force at the adoption of the constitution shall remain in force and effect until altered or repealed by the Legislature. The act of 1878 has not, as far as I have been able to discover, been altered or repealed, and it is not inconsistent with the constitution of 1879. The act of 1879 authorizes and requires the Board of Supervisors to fix the maximum rate and price for each 1,000 cubic feet to be charged for gas by any person, and that such price may be changed from time to time, not oftener than once every year, as increased consumption or other circumstances in their judgment may require. In conclusion, I will repeat that the municipal government of the city and county of San Francisco can, through its Board of Supervisors, pass an ordinance or resolution in its usual mode of passing ordinances or resolutions regulating the charges for gas for artificial light furnished the municipality or the inhabitants thereof by individuals or by any company duly incorporated for such purposes under and by virtue of the laws of California.'"

MR. J. H. WOODSON has succeeded Mr. J. T. Long as Superintendent of the gas works at Staunton, Va.

THE new drawbridge at Flushing, L. I., is fast approaching completion, as the Berlin Iron Bridge Company, of East Berlin, Conn., the contractor for the structure, has a large force of men on it.

THE proprietors of the Gas and Electric Light Company, of Lincoln, Ills., have certified to an increase in the capital stock of $30,000. The total present capital is $80,000.

ADVICES from St. Louis, Mo., are to the effect that on September 1st the long-pending consolidation of the Municipal and the Missouri Electric Light Companies of that city was completed. The identity of both Companies will be nominally lost in that of the Edison Illuminating Company, but those who were prominent in the management of the Missouri Company will have a large share in the administration of the mechanical department of the consolidated enterprise, and it is also asserted that the executives of the erstwhile Municipal Company will be retired. The reasons for the consolidation are mainly financial, especially in respect of the Municipal, the debt of which was very heavy.

MR. A. T. DAVIS, writing to the JOURNAL, under date of September 1st, from Davenport, Ia., forwards the following synopsis of the proposition submitted to the authorities for the public lighting of Waterloo, Ia., by the proprietors of the Waterloo Gas and Electric Light Company: First—Said Company will furnish twenty five 1,200 candle power electric lights, to run all night and every night in the year, at $11 per month per lamp; or, it will furnish 45 such lights, to run same length of time and in same manner, at $9.50 per month for each lamp. Second—It will furnish 25 electric lights of the same candle power, to run on the Philadelphia moon schedule at $10.50 per month for each lamp; or, it will furnish 45 of such lamps, run on same schedule, at $9 per month for each lamp. Third—It will furnish 20 lamps of the named lighting value, to run every night until midnight, at $6 per month for each lamp; or, it will furnish 25 of such lamps, to run until midnight every night, at $5.75 per month for each lamp: or, it will furnish 40 of the same, and to run the same, at $5.25 for each lamp. The other sections are devoted to conditions for extension of service, etc., and the Company further agrees to maintain the gas lights now in use, and such additional ones as may be ordered by the city, for $1.83⅓ per month per lamp, the payments on account of the service to be made monthly; and the contract is to run for a period of 10 years.

THE interest held by Mr. William T. Johnson in the Dover (Del.) Gas Light Company has been purchased by Mr. H. A. Richardson. The latter gentleman is now virtually the sole proprietor of the Company.

ADVICES from Clyde, N. Y., dated August 29th, are to the effect that the Clyde gas works, owned by Mr. H. B. Stevens, of Rochester, had a narrow escape from destruction by fire. The main building caught fire from a leaking pipe. An alarm brought out the fire department in double-quick time, as the works are located in a very dangerous quarter, being situated between the Canal and the Central Hudson Railroad. The fire was put out before much damage had been done, and the loss incurred is covered by insurance.

THE works of the Great Western Electric Company, Duluth, Minn., have been closed, the men having refused to consent to an average cut of 30 per cent. in their wages.

THE Assistant District Attorney for the District of Columbia (Mr. A. B. Duvall) has submitted to the Commissioners his opinion in relation to the unlawful construction of a plant for the manufacture of illuminating gas from oil at No. 224 New Jersey avenue, Northwest. He states that he finds no regulation which especially covers the status of the case, and that while the use of gasoline for industrial purposes seems to be expressly permitted by the police regulations, it is nevertheless clearly within the power of the Commissioners to regulate the quantity used and the conditions of such use. He is also of the opinion that such a regulation could be framed to meet, after due notice, this case, if its discontinuance is necessary for the protection of life, health or property; but he is without sufficient data to submit the draft of a regulation on the subject.

THE West Coast Plumbing and Supply Company, with headquarters at 50 First street, San Francisco, has failed, much to the disgust of many Eastern creditors, prominent among whom are the Ironclad Manufacturing Company of this city.

THE following preamble and resolutions were adopted by the Directors of the New Bedford Gas and Edison Light Company at a meeting held August 28th:

Whereas, By the ruling of that Providence which so mysteriously orders our destinies, we have been called upon to part with our former business associate and adviser, Mr. William J. Rotch, in whose counsel we have always found a high standard of honor and business sagacity, and whose advice and presence we shall greatly miss, it is

Resolved, While regretting our own loss, we would extend to his wife and family our sincere sympathy in this their deepest hour of sorrow.

Resolved, That these minutes be spread upon the records of the Company, and that a copy of the same be sent to his family.

ACCORDING to the Pittsburgh *Dispatch* a number of suits for damages have been filed against the Consolidated Gas Company of that city. The plaintiffs are William H. Williams, Lottie Williams, Isabella P. Williams, Susan S. and Mary J. Comstock, and Nicholas, Ollie and Mary Coleman. The only statement of action filed was that by Wm. H. Williams, who alleges the Company allowed its pipes in Smallman street to get in such condition that the gas escaping therefrom penetrated his house, causing such sickness in his family that he was compelled to change his habitation. The damages claimed amount to $5,000.

PROPOSALS for installing an electric lighting plant in the building of the Willard (N. Y.) State Hospital were opened Saturday last.

A DISPATCH from Logansport, Ind., dated September 1st, conveys the news that the gas war which has prevailed at that point has been settled. The old Company sold out to its rival.

MR. F. A. SABBATON, of Troy, N. Y., has been appointed Superintendent of the Glens Falls (N. Y.) Gas Light Company, succeeding his brother, Paul A. Sabbaton; and the latter has taken charge of the plant at Whitehall, N. Y.

WE understand that the authorities of West Duluth, Minn., have instituted proceedings to annul the charter of the West Duluth Water and Light Company. We have no particulars respecting the cause for the action.

THE Board of Supervisors of Stockton, Cal., have advertised for bids for a gasholder for the storage of the surplus gas issuing from the natural gas well that was sunk on the jail property, which well is said by the Stockton *Independent* to be up to the supplying of all the gas needed for the heating and lighting of the jail and county court house buildings.

THE appropriation for the public lighting of the town of New Utrecht by gas for the ensuing year is returned at $102,000.

M. J. LAYDON, formerly in charge of the works at Schenectady, N.Y., is now in the service of the Citizens Company, of Brooklyn, N.Y., at its 26th ward branch.

The Market for Gas Securities.

Consolidated sold up to 127 during the week, and opened to-day (Friday) at 127 to 128. Holders may look forward to continued appreciation in those shares for some time to come. Equitable is in some demand at advancing figures, and Mutual holds its own. The Brooklyn situation shows no change, unless it is that the Companies are showing more distrust of each other than usual. Chicago gas, after selling up to 63, broke to 57½, on the announcement that the Peoples branch of the confederacy was to make a new bond issue (6's, to run 50 years), and that the scrip dividend recently declared would be exchanged for bonds, in $1,000 lots. Baltimore Consolidated advanced to 57½, Laclede common to 14, and Bay State to 18½ bid.

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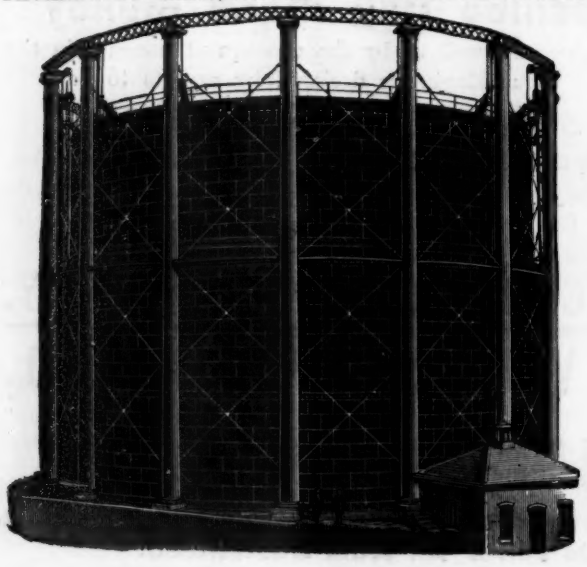

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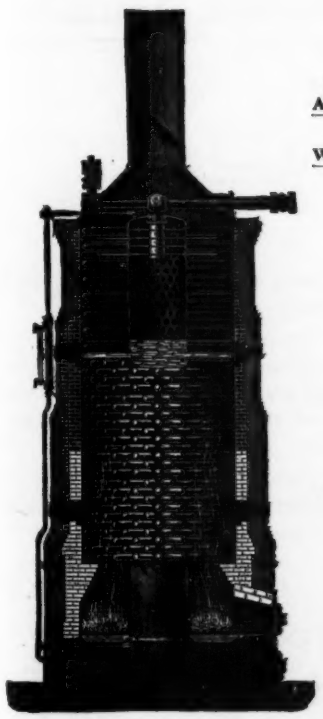

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Cable Address, "PAILA," NEW YORK.
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Long Distance Telephone, 1229-18th St., New York.

This Boiler is producing unequaled results in the works of most of the principal Gas Co.'s of the U.S., and in similar plants in Foreign Countries

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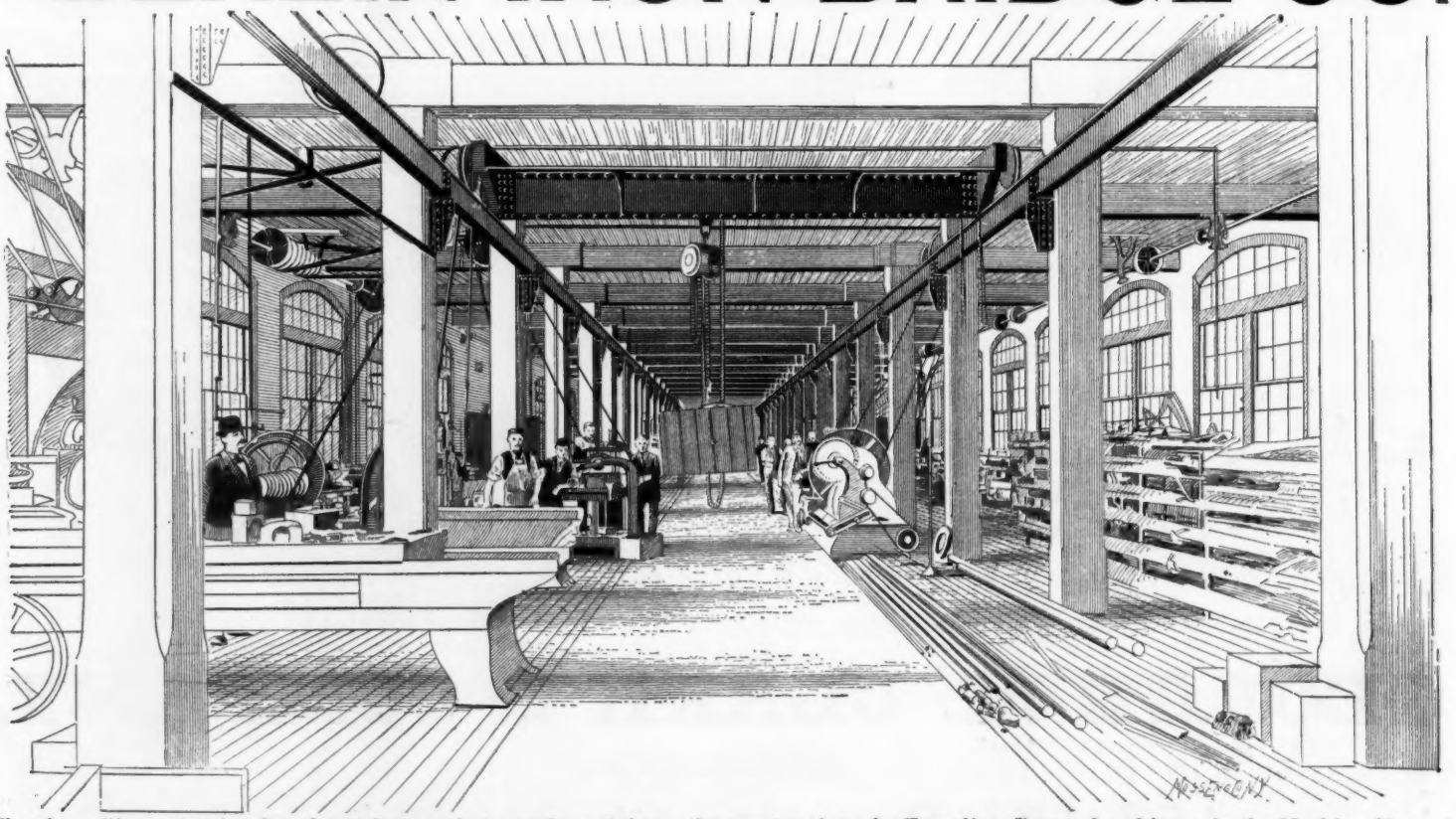

The above illustration is taken direct from a photograph, and shows the construction of a Traveling Crane placed by us in the Machine Shop of the National Meter Company, at Brooklyn, N. Y. The building is the usual construction of brick walls with wooden posts supporting wooden floors. The crane girders are attached to wooden posts, and the Crane has a travel the full length of the building between the posts. The plan commends itself where parties desire to control a limited floor space in a building already built.

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FROM

GAS.

MR. WALTON CLARK, Assistant General Superintendent, United Gas Improvement Co.:

Dear Sir—In accordance with your request, I have made several ests of the new Welsbach mantel (called No. 169) for candle power and efficiency, and I herewith submit the following results:

	Candle Power.	Pressure.	Gas Consumed.	C.P. per Cu. Ft.
Average of Test No. 1,	67.05	.95 in.	2.6	25.70
" " No. 2,	63.86	1.00 in.	2.86	22.30
" " No. 3,	72.50	2.1 in.	2.87	25.26

The above averages are the results of trials on three different occasions, and in each case the mantles tested were made from a different lot of fluid.

The mantles used in the above tests were selected at random, and all had been dipped in kristaline and dried ready for shipment.

It is quite possible that better results could have been obtained by manipulating and readjusting the position of the mantles on the galleries, and also by waiting a longer period after burning off the kristaline; but I considered such fine adjustment undesirable in determining the commercial candle power.

These tests were made on a bar photometer against a regular Edgerton standard slit. The candle power of the slit was 6.18, and the gas used was Gloucester City water gas, 26 candle power.

Very truly yours,
(Signed) C. H. PAGE, JR., M.E.

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HIGH CANDLE POWER WELSBACH LIGHTS.

Gloucester, N. J. WELSBACH LIGHT CO.

NEWBIGGING'S HANDBOOK FOR GAS ENGINEERS AND MANAGERS.

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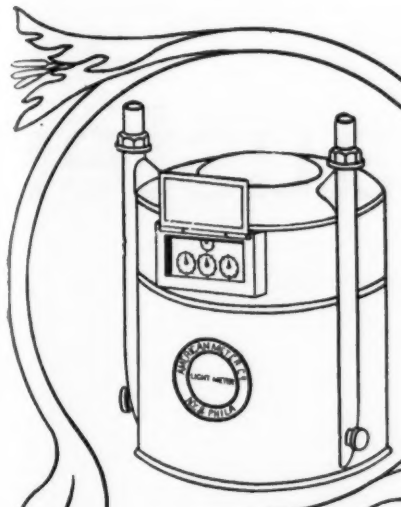

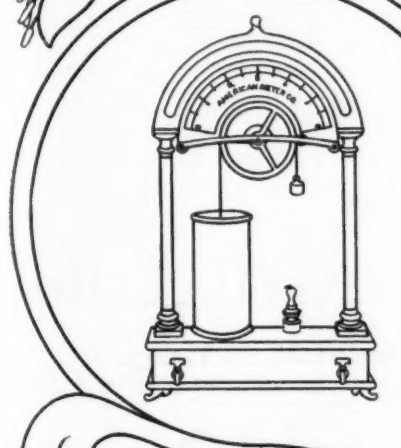

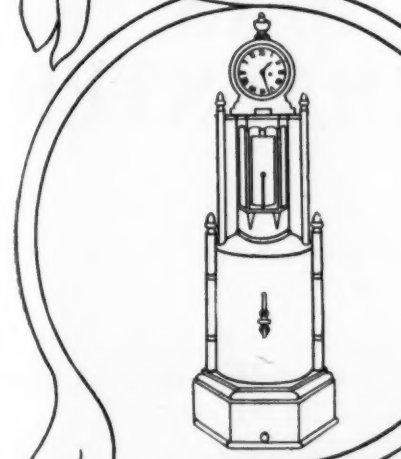

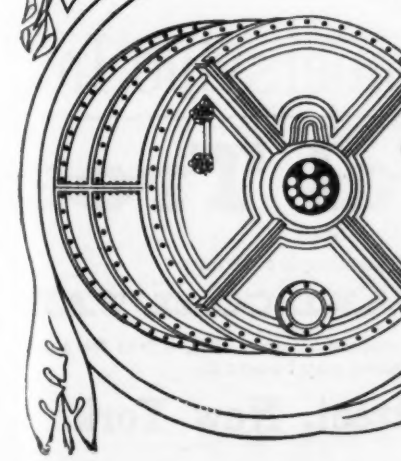

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NEW YORK and PHILADELPHIA.

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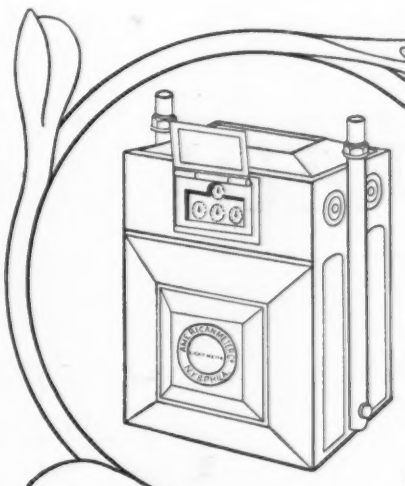
PUBLIC LIGHTING TABLE.

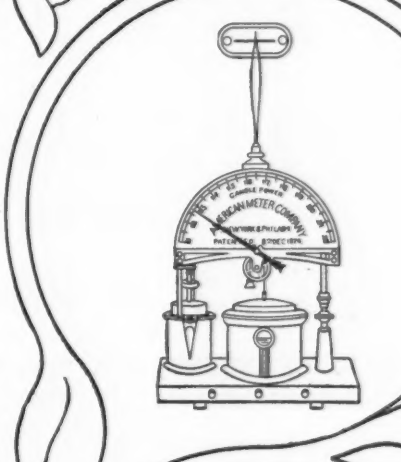
SEPTEMBER, 1893.

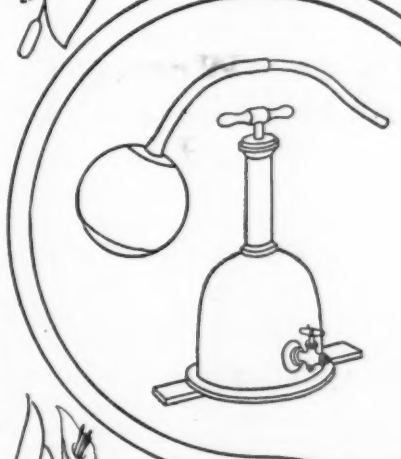
Day of Week.	Table No. 1. Following the Moon.			Table No. 2. New York City. All Night Lighting.	
	Date.	Light.	Extinguish.	Light.	Extinguish.
				P.M.	A.M.
Fri.	1	7.00 PM	10.10 PM	6.30	4.20
Sat.	2	7.00	11.00	6.30	4.20
Sun.	3	7.00 LQ	11.40	6.15	4.30
Mon.	4	7.00	12.40 AM	6.15	4.30
Tue.	5	7.00	1.50	6.15	4.30
Wed.	6	6.50	3.10	6.15	4.30
Thu.	7	6.50	4.30	6.15	4.30
Fri.	8	6.50	4.30	6.15	4.30
Sat.	9	6.50	4.40	6.15	4.30
Sun.	10	6.50 NM	4.40	6.05	4.40
Mon.	11	6.50	4.40	6.05	4.40
Tue.	12	6.40	4.40	6.05	4.40
Wed.	13	6.40	4.40	6.05	4.40
Thu.	14	6.40	4.40	6.05	4.40
Fri.	15	7.40	4.40	6.05	4.40
Sat.	16	8.20	4.40	6.05	4.40
Sun.	17	9.00 FQ	4.40	5.55	4.50
Mon.	18	9.50	4.40	5.55	4.50
Tue.	19	10.50	4.50	5.55	4.50
Wed.	20	11.50	4.50	5.55	4.50
Thu.	21	1.00 AM	4.50	5.55	4.50
Fri.	22	2.10	4.50	5.55	4.50
Sat.	23	3.10	4.50	5.55	4.50
Sun.	24	No L	No L.	5.40	5.00
Mon.	25	No L FM	No L.	5.40	5.00
Tue.	26	No L	No L.	5.40	5.00
Wed.	27	6.20 PM	7.50 PM	5.40	5.00
Thu.	28	6.20	8.20	5.40	5.00
Fri.	29	6.20	8.50	5.40	5.00
Sat.	30	6.20	9.40	5.40	5.00

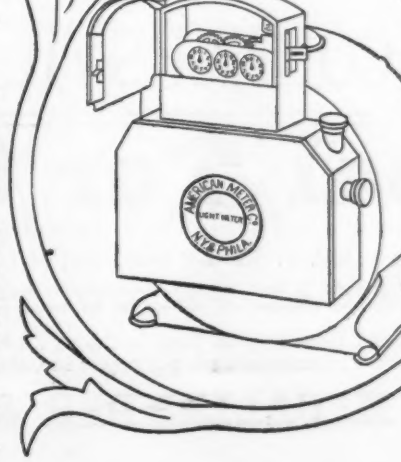
TOTAL HOURS LIGHTING DURING 1893.

By Table No. 1.	Hrs.Min.	By Table No. 2.	Hrs.Min.
January...	217.30	January...	423.20
February..	200.30	February..	355.25
March	177.50	March	355.35
April.....	160.30	April.....	298.50
May.....	149.00	May.....	264.50
June.....	140.30	June.....	234.25
July.....	143.40	July.....	243.45
August....	154.50	August....	280.25
September.	171.50	September.	321.15
October....	202.20	October....	374.30
November.	221.30	November.	401.40
December.	248.50	December.	433.45
Total..	2188.50	Total..	3987.45









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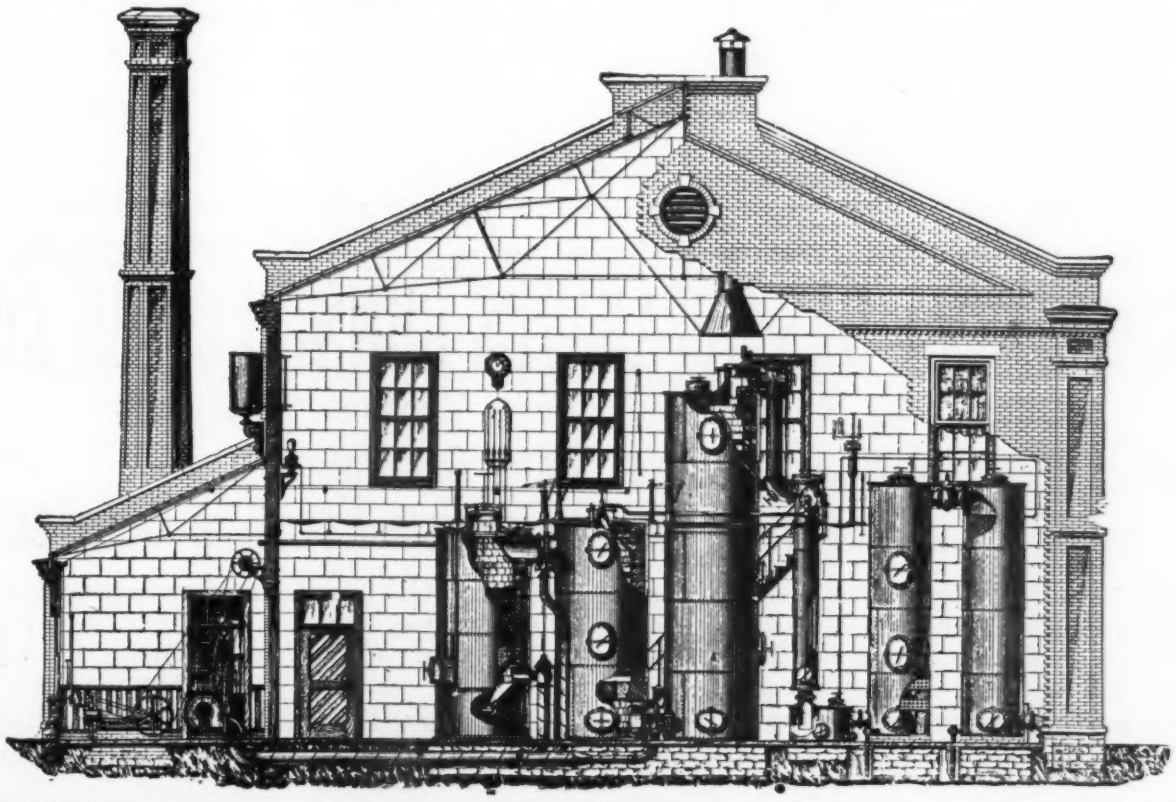

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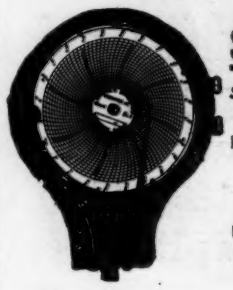

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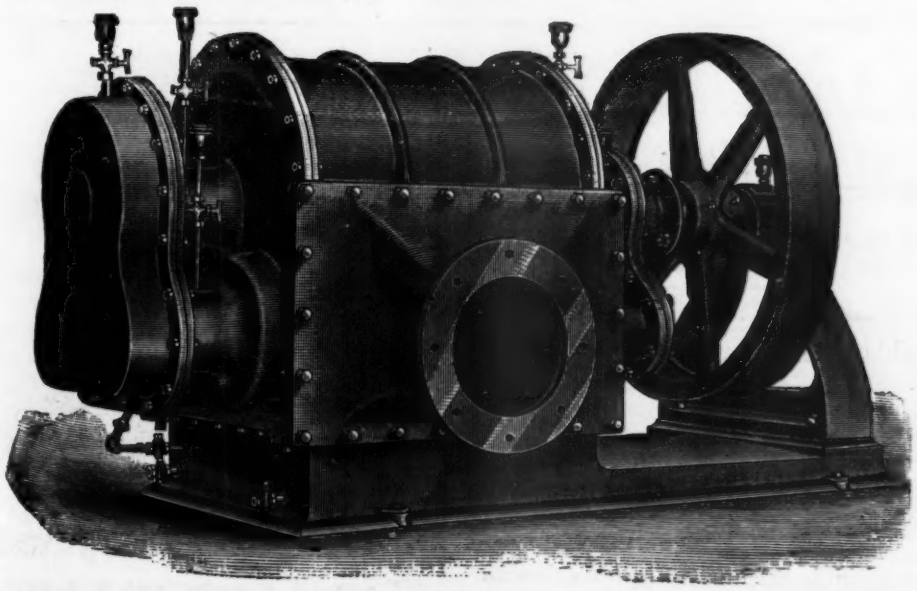

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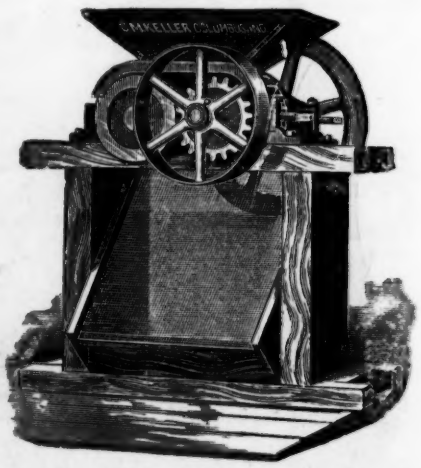

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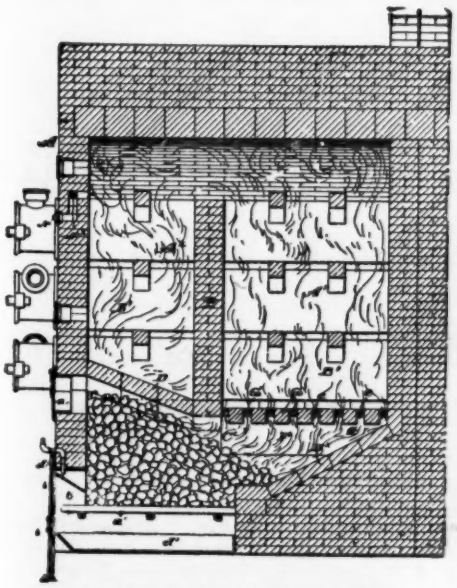

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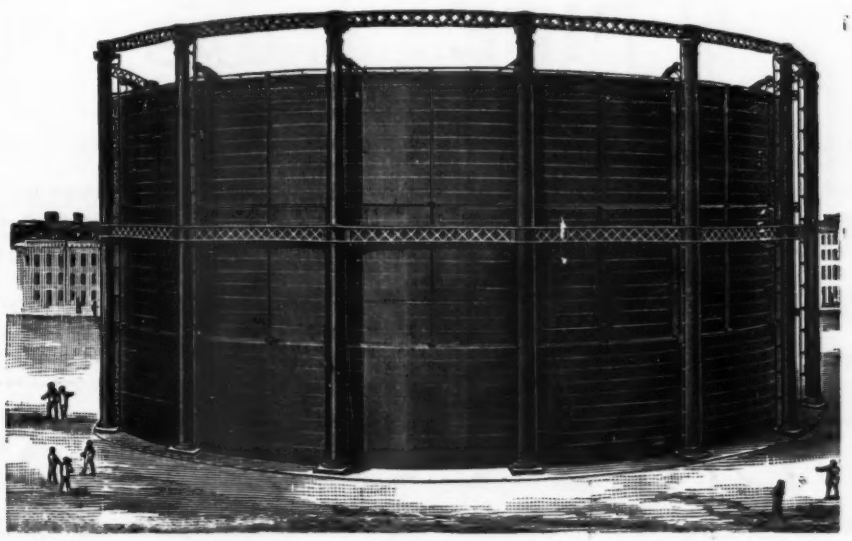

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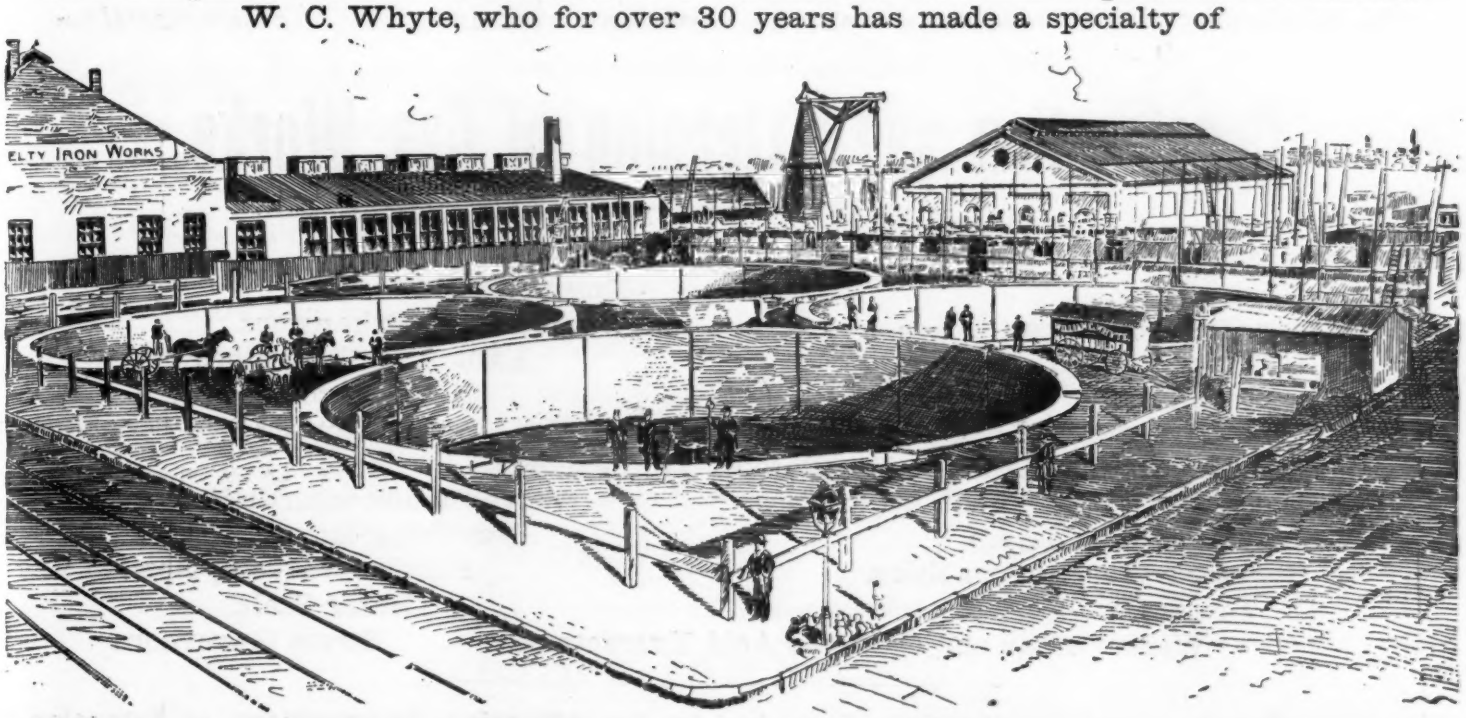

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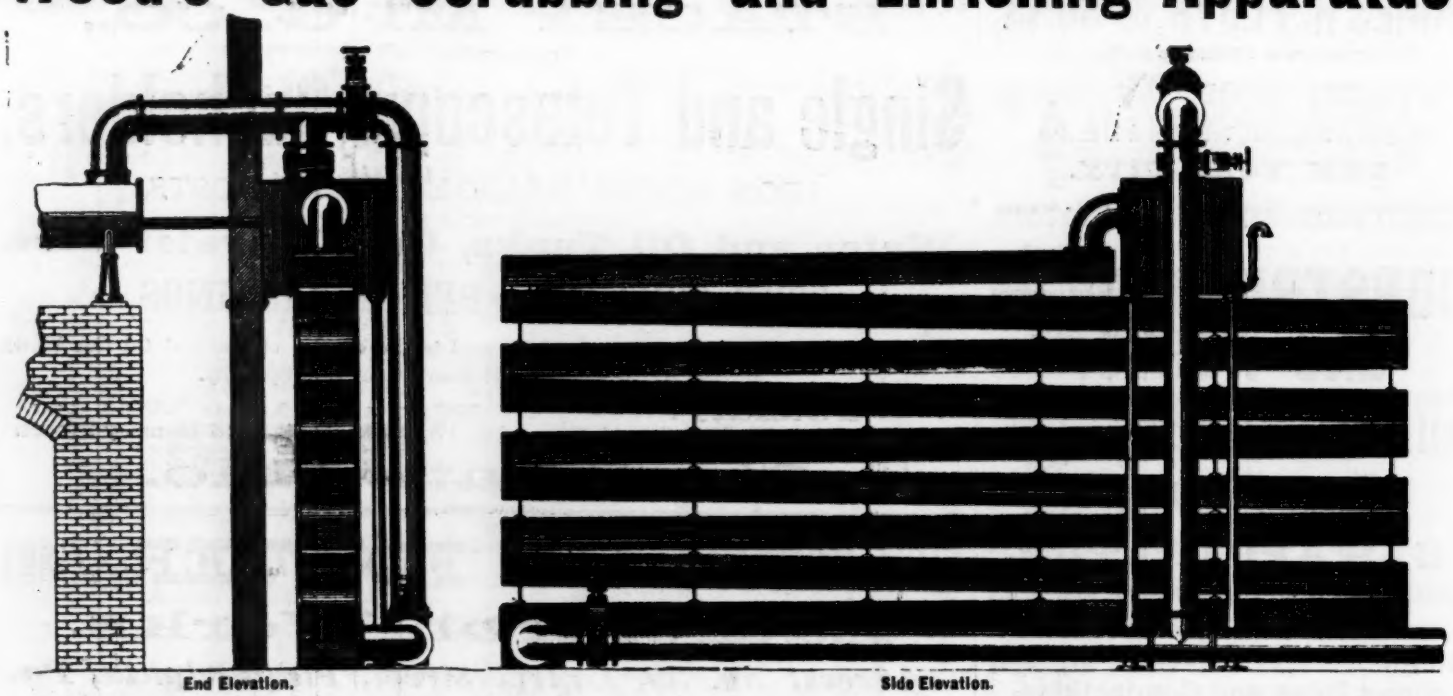

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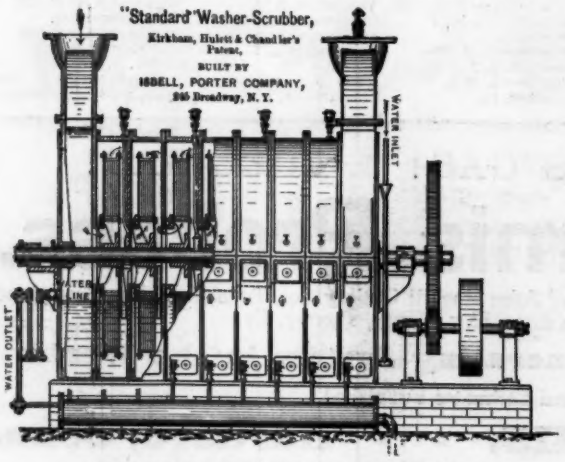

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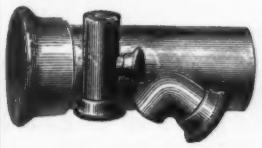

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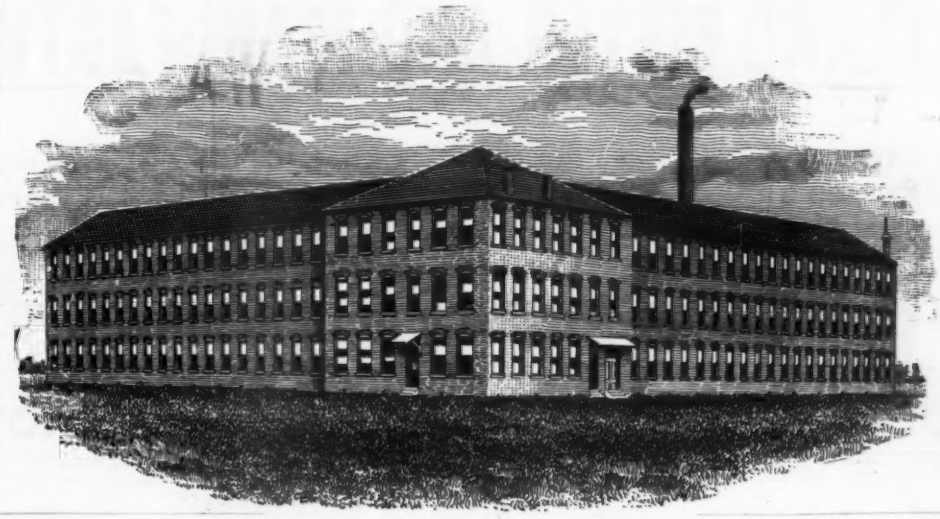

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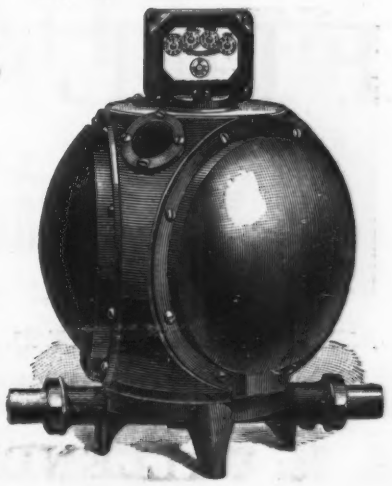

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SIZE.

Stove.	*Oven.*	*Broiler.*	*Top.*
31 inches high.	9¼ inches high.	10 inches high.	21 inches high.
17 inches wide.	15 inches wide.	15 inches wide.	16 inches wide.
	12¼ inches deep.	12¼ inches deep.	
	Length over extension shelves, 32 inches.		

This Stove has three Boiling Burners in the Top or Hot Plate, and single Oven Burner.

The consumption of this Stove is 35 cubic feet per hour, at 1¼ inch pressure with all burners.

Three-eighth inch supply pipe should be used when the pressure is 1¼ inches or over.

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